The DENTAL JOURNAL OF Australia

AUSTRALIAN DENTAL ASSOCIATION
N.S.W. BRANCH

VOLUME - - 33
NUMBER - - 4
APRIL - - 1951

The DENTAL Journal OF AUSTRALIA

Vol. 23 April, 1951 No. 4

CONTENTS

Honorary Editor: H. R. SULLIVAN, M.D.S.

Published by the Australian Dental Association (N.S.W. Branch)
B.M.A. HOUSE, 135-137 MACQUARIE STREET, SYDNEY.

Communications intended for publication in "The Dental Journal of Australia" should be addressed to the Editor. All advertising and business matters should be directed to the Secretary.

Subscription: £1/5/- per annum; Overseas, £1/10/-; Single Copy, 2/6.

The DENTAL Journal OF AUSTRALIA

Vol. 23 April, 1951 No. 4

ANATOMICAL AND PHYSIOLOGICAL CONSIDERATIONS FOR THE POSITIONS OF THE MANDIBLE*

JOHN R. THOMPSON, D.D.S., M.S.D., M.S.†

The vertical and horizontal positions of the mandible are of primary concern to the practitioner of most phases of dentistry. The problem is no different for the prosthodontist, periodontist, restorative dentist or orthodontist with the exception, in the case of the latter, of the changes in size of the facial structures induced by growth. As the profession realizes that it is concerned with the maintenance of the health and function of the masticating system as a whole methods of treatment will become less empirical. This system is probably better named the stomatognathic system (suggested by Dr. George B. Benton) derived on a morphological basis as the functional terminology limits the scope of its function. It is not only the masticating system but the parts function collectively in speech, deglutition, respiration and in the maintenance of posture.

The system includes not only the teeth and their supporting tissues but also the mandible and maxilla proper, the temporo-mandibular articulation, the musculature with its nerve and vascular supply, ligaments and other less important structures. Knowledge of the anatomy, growth and physiology of the system forms the basis for diagnosis, analysis and treatment of abnormal function of the system whether it be restoration of as near adequate function as possible with a full denture prosthesis or the correction of temporo-mandibular joint disorder. The parts of the system must never be thought of as individual units but always collectively with the realization that detrimental changes in one part will have their influence similarly on the others and on their co-ordinated function.

Concerning the mandible three basic positions must be recognized to exist. They are rest position, occlusal position and centric position. The rest position, or rather the rest relation of the mandible to the maxilla, is established before any of the teeth erupt. It is dependent entirely upon the equalization or balance of the tensions of all of the muscles attached to the mandible (Brodie) and is in no way related to the presence or absence of the teeth. As the teeth erupt the relation of the mandible to the maxilla at rest position is not changed even though the structures are increasing in size. The facial proportions measured

*Presented at the Twelfth Australian Dental Congress, Sydney, August, 1950.

†Professor of Orthodontics, Northwestern University Dental School.

with the mandible at rest position are not changed with growth. Evidence has been gathered strongly to suggest that a high degree of stability exists in a mandibular resting position after the teeth have been extracted. All mandibular movements begin from this position and the mandible returns to it once the functional movement is completed. All other mandibular positions are functional and require increased muscular effort in order to maintain a static relationship, viz., holding the teeth in occlusion or the mandible protruded. More detailed discussions of this position have been presented in earlier publications and need not be repeated here. In passing, however, it must be realized that there are variables in the rest position and these may be thought of as variations within a pattern of stability. Now that a broader concept of mandibular position has been established the variations can be better understood. They are related to alterations in the tonicity of the musculature, such as hypotonicity as seen in fatigue, debilitating disease and conditions of generally diminished tonicity. The adverse situation of hypertonicity also exists in varying degrees and the extreme is seen in muscle trismus which may completely obscure the normal resting position. With the proper treatment the trismus can be relieved; therefore, it is variation within a pattern of stability. In such instances the case history and recognition of objective and subjective symptoms of abnormal function (clicking and crepitus of the temporo-mandibular joints, pain limitation of opening, abnormal pattern of attrition, etc.) aid in the determination of the correct occlusal position.

When the teeth are occluded the interlocking of the cusps determines the occlusal mandibular position. This position is not established until the teeth erupt into occlusion, it varies as the occlusion is altered and it is lost when the teeth are extracted. It is the position that the dentist seeks to change in orthodontic treatment and to restore in complete denture prosthesis.

Harmony between the rest and occlusal positions is seen in the consideration of centric position. Centric position has been described in many ways, and thus, considerable confusion and differences in opinion and terminology exist. Centric position is not only that mandibulo-maxillary relation where the teeth should occlude in the normal or good functioning situation but also where the condyle is in a balanced and unstrained position in the temporo-mandibular fossa. If in attaining the occlusal position the mandible has closed through an acceptable interocclusal clearance (free-way space) on a normal path of closure the occlusal position will be identical with the centric position. This represents harmony with the rest position in the vertical plane (acceptable interocclusal clearance) and in the horizontal plane (normal path of closure). The centric position involves considerations of the teeth, musculature and temporo-mandibular joints and it necessitates an understanding of their anatomy, growth and physiology.

I believe, from observations made on adult cadaver and skull material and from radiographic studies, that in the normal joint of adults the antero-superior surface of the condyle is in close approximation to the postero-inferior surface of the articular eminence. They are not in contact as the thin central portion of the articular disc rests in between. The thickened posterior margin of the disc is directly above the superior margin of the condyle and the disc divides the joint cavity into a smaller lower section and larger upper section. While the anterior relation of the condyle in the fossa is fairly constant, accepting, of

course, the range of normal variation, the space superior and posterior to the condyle varies in size in different individuals.

In all of our studies on the closing movement of the mandible from rest position to occlusion of the teeth made on young adults and adults with excellent dental occlusion, the lower portion of the joint functions primarily. The normal movement was with the axis located in the vicinity of the condyles or lower portion of the joints. The mandibular incisors and the chin point swing upward and forward. The molars move on a similar but smaller arc since they are nearer to the axis. It is important to note that there may be slight bodily movement of the condyles and slight movement should still be considered to be within the normal range. The apparent bodily movement of the superior portion of the condyle, indicated on some radiographs, may actually still be a hinge movement if the axis is slightly below the centre of the condyle.

On opening the mouth from occlusion, the hinge movement functions until rest position is exceeded, then the condyle moves downward and forward. The joint is now functioning as a hinge the socket of which is moving. The movement of the hinge or bodily movement of the condyle occurs in the upper portion of the joint. If one understands these simple movements then the complex movements of speech and mastication can be envisioned.

As the mandible moves from rest position to the occlusal position all teeth, with the possible exception of the incisors in some cases, come into occlusion at approximately the same time. In some instances this does not occur and certain tooth surfaces may come into contact before the mandibular teeth have closed through an acceptable interocclusal clearance. These teeth may have more mobility than usual and may be felt to "jiggle" when the teeth are tapped together. The mandible will be required to shift or rock slightly in order to attain occlusion of the remaining teeth. This is described as premature contact.

Another situation wherein all teeth do not occlude simultaneously is described as initial contact. In this instance the mandibular teeth close through an acceptable interocclusal clearance until certain teeth, usually the incisors, come into contact. The mandible is then directed on an abnormal path of closure until the remaining posterior teeth are occluded. Usually the teeth in initial contact do not have more mobility than usual. During mastication or on closing from an open mouth position the mandible moves directly into the position of displacement but on closing from rest position the mandible is seen to close on a normal path of closure until the point of initial contact and then to deviate onto an abnormal path of closure until the remaining teeth occlude.

The distinction between premature and initial contact, while it is largely a matter of judgment rather than measurement, is important as it is suggestive of proper treatment. In the former the area of premature contact must be removed by occlusal grinding, while in the latter the posterior teeth must be restored to the level of the initial contact. It should be clear that some cases require a combination of these treatments. The objective of the treatment is to make the occlusal position identical with the centric position. When this is accomplished the opening and closing movement will be smooth and even, without the mid-line deviating. Light palpatation of the joints does not detect any crepitus. When, however, the occlusal position is posterior to the centric, the

mandible having been displaced posteriorly and superiorly with the condyles retruded into a nonfunctioning part of the fossa, the movement may be irregular. When the fingers are placed lightly over the joint areas crepitus is noted. The

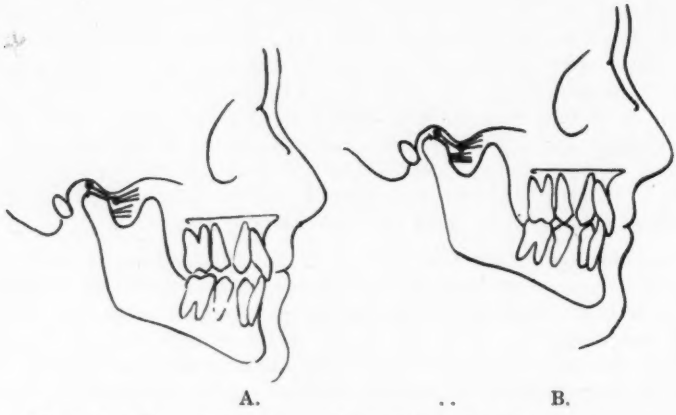

Figure 1.—Normal and abnormal relation of the joint structures.

A.—Good relation of condyle, disc and articular eminence. Mandible is in rest position.

B.—Posterior-superior displacement of condyle. Dislocation in lower portion of the joint.

patient may complain of "clicking" and it may be quite audible during mastication or it may be so slight that it can hardly be detected. It represents abnormal function of one or both joints forced upon them by malocclusion of the teeth. In Figure 1A the normal relation of the joint structures are shown diagrammatically. The superior head of the external pterygoid muscle is attached to the anterior margin of the articular disc. The lower portion is attached to the mandible. Sicher has pointed out that an important function of the superior head is to prevent posterior movement of the disc. Now let us consider the malocclusion portrayed in Figure 1B. The interocclusal clearance is wide and distorted. The curve of Spee in the upper arch is reversed and in the lower arch it is excessive. When the teeth are occluded the overbite is deep. It is obvious that the mandible must be moved on an upward and backward abnormal path in order to occlude the posterior teeth. A click occurs as the condyle moves distally and according to Sicher it represents a dislocation in the lower portion of the joint (normally hinge action only takes place in the lower portion). The disc is restrained from moving distally with the condyle by the upper head of the external pterygoid muscle (Sicher). The lower portion of the muscle is over-extended when the teeth are occluded and it may rebel in the form of muscle pain, trismus or irregular function. It was stated that a click occurs as the condyle moves distally. Another click takes place as the mouth is opened and if the teeth are not occluded the clicking will not occur as the mandible moves in the function of speech, except in extreme abnormal functional cases, but once the teeth are occluded again the click occurs. It seems that the click is felt or heard at the moment when the posterior margin of the articular disc is impinged

in the pressure area between the antero-superior of the condyle and the postero-inferior surface of the articular eminence and then "snaps" into position as the condyle and disc are moved. If the dislocation is prevented by placing thin occlusal splints or a bite plate the clicking is eliminated. The splints are preferable to the bite plate as they are worn continually.

Mandibular displacement may occur in any direction. Lateral, posterior and forward displacements are deviations primarily in the horizontal or slightly oblique plane. Inferior displacement occurs when an excessive occlusal vertical dimension is established and superior displacement is associated with a deficient occlusal vertical dimension. In the former the interocclusal clearance is eliminated and in the latter it is very large. An example of the large interocclusal clearance is that seen in the individual in whom a cleft palate was closed by traumatic surgical procedures at a very early age. In these individuals the growth potential of the maxilla is all but destroyed. As the mandible grows in a normal manner but the maxilla does not, the interocclusal clearance becomes larger. We have observed this space to be as high as twenty millimetres in a fourteen year old child.

Consideration of the rest position and occlusal position of the mandible in the vertical plane leads us to a discussion of the vertical dimension of the face. The assumption that this dimension decreases when the teeth are extracted and that the facial changes observed are the result of this decrease is no longer valid. It has created much needless discomfort both on the part of the patient and the operator simply because a vertical dimension was established that eliminated the necessary interocclusal clearance or actually exceeded the resting length of the closing muscles. The resting length of the muscles does not lengthen or shorten according to our desires.

A better understanding of the vertical dimension can be brought about by distinguishing two vertical measurements rather than one, the rest vertical dimension and the occlusal vertical dimension. The former is determined by the musculature and it will not be altered by the loss of the teeth. The latter, the occlusal vertical dimension, is dependent entirely upon the teeth. It changes as the occlusion changes and it is lost when the teeth are lost. Centric position in the horizontal plane has been discussed and it was stated that in the normal or good functioning situation the occlusal position should be the same as the centric. Centric position exists in the vertical plane as well. Here again the occlusal position should be the same as the centric. Now it is seen that rest position, centric position and occlusal position should be visualized in all three planes of space.

If the concept that the position of the mandible is dependent on the balance of its musculature is true, then abuse of this principle in any of the phases of dentistry should have undesirable results. Several years ago this problem was investigated by tracing the changes that occur after the placement of prosthetic restorations. This study was based on radiographs obtained by means of the Broadbent Bolton Cephalometer. This method permits a high degree of accuracy, since the relation of the X-ray tube, films and patient are constant and serial radiographs can be made. Therefore, any changes in the teeth, alveolar process, or the position of the mandible can be accurately recorded and studied. Several radiographs of the head were made on a large group of patients requiring complete or partial dentures. These were taken before any teeth were removed,

after the removal, before the insertion of the dentures and at approximately six-month intervals thereafter.

The evidence reported in earlier publications strongly supports the contention that the physiological rest position of the mandible is stable. If the mandible is carried, by artificial restorations, to a position beyond that of physiologic rest, it will return to this position at the expense of resorption of the supporting bone. This is unquestionably one reason for failure of certain cases of partial or complete dentures and restorative dentistry.

The works of Neiswonger, Gillis, Tench, Schlosser and Holic should be studied for practical application of the concepts presented in this paper.

The problem of aesthetics as it relates to vertical dimension requires clarification. Just as we must speak of vertical dimension as the rest vertical and occlusal vertical dimensions so must aesthetics be further classified under three distinct and separate headings. The first is dental aesthetics in which the arrangement, form, size and shade of the teeth are considered. The second is the rest aesthetics and this refers to the contour of the face when the mandible is at rest position. The teeth are separated and occlusal vertical dimension does not influence the facial contour when the mandible is at rest position. The degree of fullness or lack of fullness of the lips is dependent upon the antero-posterior or horizontal positioning of the maxillary incisors in relation to the facial plane. When the teeth are moved too far to the anterior of this plane by orthodontic therapy or placed there in denture construction the lips are prominent and are under tension. The reverse situation exists when the teeth are too far to the posterior or when they are lost. Therefore, as you observe the patient's face do not think in terms of vertical dimension but rather in terms of horizontal position of the incisor teeth. The third classification is functional aesthetics and this is related to the occlusal vertical dimension. In the edentulous individual the lips bulge forward as he overcloses in function. In the case of the cleft palate patient referred to earlier the lips are protruded as he overcloses in order to masticate. If in the construction of complete dentures the occlusal vertical dimension is too short the interocclusal clearance will be large and functional aesthetics will be poor.

In conclusion, I wish to express a personal opinion. The dental profession has made remarkable progress in technical procedures and materials used; however, we have not made like progress in our understanding of the living stomatognathic system that we are treating. As our knowledge of this system and particularly of its highly co-ordinated functions increases, our techniques will be applied so as to conform with the unchanging physiological factors.

PREVENTIVE ORTHODONTICS*

K. T. ADAMSON, D.D.Sc.

Goethe, the great German philosopher and poet, once said, "There is little that can be done for grown-up people; the intelligent man begins with the child." He was certainly not thinking of orthodontics or any other phase of dentistry when he wrote those words, yet, they could well be the motto of any section of the community interested in any phase of Preventive Medicine, but particularly Dentistry. "Prevention is better than cure" is a truism which now unfortunately seems to be regarded as a trite saying.

Preventive Orthodontics may be defined as the carrying out of certain procedures with the object of preventing the development of a malocclusion or, if that is not possible, at least reducing the severity of the impending deformity.

The mere fact that one can be asked to discuss the subject "Is preventive orthodontics a practical possibility?" suggests that there is a doubt that such is the case. It would seem that the easiest way to write this paper would be to answer immediately "yes" or "no" to the question, and then try to prove my case to your satisfaction.

However, due to many past efforts the subject is rather threadbare and I hope you will pardon me if I take certain liberties, and instead of giving the same old list of things that you as general practitioners should do to attempt to prevent malocclusion, I would like to discuss the subject more generally and in so doing give you something to think about—at least sufficiently to create some discussion.

If we think about this question again, it suggests two possibilities, either that preventive orthodontics is not possible, or that if it is possible it is not successful in attaining its objective as generally practised today. If it were then we should expect to find the number of malocclusions presenting for treatment diminishing, instead of which they seem to be increasing. You may question this last statement and say that just as many malocclusions were present in past generations but they were not noticed to the same extent as they are today because the general public was not so well-informed as to the importance of developing normal healthy mouths in their children. To a small degree this may account for the increasing demand for orthodontic treatment, but it is certainly not the only reason.

To approach this question logically, we must first briefly examine, in general terms only, the aetiological factors which produce malocclusion, for if we do not know what these are we are not in a position to know whether we can control them or whether we cannot. Obviously if the majority of aetiological factors were beyond the bound of human control, then preventive orthodontics would not be a possibility.

Generally speaking, we may say that all malocclusions have their beginnings from one or a combination of any of the following factors:—

1. Heredity.
2. Evolution.
3. Environmental or local factors.

*Read at the Twelfth Australian Dental Congress, Sydney, August, 1950.

It is now an established fact that many malocclusions are the direct result of inherited faulty skull pattern. The old belief held by the Angle school that every child commences life with the possibility of developing normal occlusion provided that no interference is experienced from external influences can no longer be regarded as being correct. There is no doubt that a certain percentage of malocclusions are present at birth and that a child may be predestined to develop a malocclusion which has been handed down to it from its ancestors. This is particularly so in those malocclusions which involve an incorrect relationship of the mandible with the maxillae, namely Class II (Angle) and Class III (Angle), where the mandible is distal and mesial respectively to skull anatomy.

Secondly, evolutionary changes are said by many to be producing a retrogressive change in the human face which, as time goes on, is becoming less and less prognathic and therefore shorter and shorter antero-posteriorly; thus less room is provided for the normal dentition of 32 teeth which, apparently unaffected in size by this retrogressive evolutionary change, finds it impossible to accommodate itself in the basal bone provided, without the teeth becoming extremely crowded. In other words, in many cases there is a marked discrepancy between tooth size and basal or supporting bone.

Thirdly, there are a large number of malocclusions which are produced by the numerous environmental factors around the mouth with which we are all so familiar. There are "the same old list of things" which I referred to in my opening remarks. You all know them, and I need mention only a few to illustrate my point—premature loss of deciduous teeth, prolonged retention of deciduous teeth, the numerous habits such as thumb-sucking, lip-biting, mouth-breathing and so on. If we are to believe the statistics which are available, more than half the existing malocclusions find their origin in localized factors. Even in those cases which are the result of inheritance or evolutionary change, localized factors may add further complications to the malocclusion. Thus it would seem that, whilst we have no power to control these malocclusions which are produced by heredity or evolution, the remainder can be improved or even eliminated by the application of simple preventive measures.

If this is so, then why is preventive orthodontics not more commonly practised? I imagine there must be some who do believe that abnormal breathing, i.e., mouth breathing, tends to hinder, or should we say misdirect, the desired growth and development of certain structures which support the denture. If this be true, why should we continue to neglect making some effort to eliminate this, or at least make some attempt to control its actions. All of you also must surely agree that when deciduous teeth are prematurely lost the spaces which they occupied will in many cases rapidly disappear if some action is not taken to prevent this, yet how many conscientiously consider the need for space retainers, where extraction of deciduous teeth is forced upon them as a result of caries? To my mind there can be no justifiable reason, moral or otherwise, which permits the development of an undesired condition which is mainly preventible and which results in later years in prolonged attempts at correction.

This Congress would indeed have achieved something if we could be sure that all who attended left with the firm resolve to fill all deciduous teeth where

possible and to use space retainers where premature loss was unavoidable. For years orthodontists the world over have been preaching the importance of maintaining the deciduous dentition in position until it is lost through the normal eruption of the permanent teeth. They have also said that if they have to be lost prematurely because of caries, some thought should be given to space retainers. Yet, because the advice is not heeded, hundreds of potential malocclusions are created every day throughout this country.

It is possible that in some cases we may claim lack of opportunity at the right time; yet, who sees the patients first, the dentist or the orthodontist? In addition, the majority of children in dental practices consists of patients in the mixed dentition stage. It is here that the greatest neglect in the profession occurs, and it is possibly equally true of orthodontists—that is, the failure to supervise and direct the proper removal or retention of the first dentition. Much has been said about it, more has been written about it, but very little has been accomplished.

The fault may possibly lie in the attitude of the orthodontist himself to his profession. Not long ago at a lecture on this very subject I heard one man ask the lecturer, "How can we dentists know what is the right thing to do if orthodontists disagree so much amongst themselves on points that seem to be of primary importance? To the onlooker, orthodontics may appear to be in a state of lamentable confusion. There have been so many schools of thought, so many methods of treatment, and an infinite variety of appliances, yet there are hundreds of men throughout the world who are doing sound work each in his particular way.

Russell Logan in an article "The Place of Orthodontics in a Health Service" says, "Of all the branches of dental science that of orthodontics probably shows the least signs of approaching finality of comprehension; one may say we stand on the threshold of great advances of a fundamental nature."

It is true that on certain basic principles and in certain approaches to treatment there are widely divergent ideas amongst orthodontists, but I agree with Russell Marshall who, writing in an article, "Functional Treatment in Orthodontics," makes this statement:—"The controversy 'expansion versus extraction' which are apparently opposite policies of two instruments of treatment are by *no* means opposite." He bases this statement on the fact that both groups are working towards the same end, namely, the production of functional occlusion—that each goes about it in a different way does not necessarily imply a complete divergence of thought. He continues, "These growing pains are necessary in a very young science and at this stage of our evolution it would not be healthy if there were not many and diverse opinions."

In spite of this difference of thought, there are many points upon which orthodontists are in complete agreement; among them are some which we have already enumerated, such as the importance of maintaining the deciduous dentition in position as long as possible, the necessity for making some effort to maintain space when deciduous teeth are lost prematurely, the effect of habits upon the denture, and so on. On these points we meet on common ground, yet even they are consistently ignored by the profession as a whole. It would seem then that a confused outlook which is the outcome of the divergence of thought

amongst orthodontists themselves is not a valid excuse for the apparent failure of preventive orthodontics.

The second reason which one finds most commonly put forward is that the dentist knows nothing about the subject. If such is the case then perhaps that is his own fault, or it may have been his teaching which has failed to stimulate his interest in the subject. There has been, and perhaps there still is, a tendency in some schools to make orthodontics a subject which is almost apart from dentistry. If it is thought of in terms of complicated appliances understood by only a favoured few, the student must gain the idea that when he is finished with the subject for examination purposes he is finished with it for good. This totally incorrect attitude of mind may eventually lead him to believe that anything in the nature of orthodontics is outside his sphere of work. If this has been the case in the past it is time that this impression was erased from the minds of all.

The tendency throughout the majority of dental schools in the world today is to correlate orthodontics with children's dentistry. This is done in most Continental schools, in England, and has been instituted in some parts of America. It is something which could well be considered in this country. What could be more closely allied to any phase of pedodontia? The two go hand in hand. The production of healthy teeth as a result of correct diet, etc., the maintenance of a healthy dentition by correct instruction in mouth hygiene and by vigilant care on the part of the dentist who, with the aid of radiographs, makes periodical clinical examinations of the mouth—this is pedodontia; ally with this a reasonable knowledge of normal occlusion and what it really means, an understanding of the growth and development of the jaws, the ability to recognise incipient malocclusion and the knowledge of simple preventive methods in relation to malocclusion—which is really diagnostic orthodontia—and you have the complete picture.

We must convince the dental profession that diagnostic orthodontics is part of his service to his child patients. Then and then only will we achieve any success in the preventive field, for is it not the dentist who sees the patient first? Is this a practical possibility, or the dream of a dental Utopia? I believe it is not only a possibility, but an essential.

In a recent publication "Dentistry for Children," Brauer states:—"Many difficult problems confronting the general practitioner and orthodontist could be eliminated if preventive orthodontics were more thoroughly understood and practised by all dentists who do work for children. Under such conditions, true denture guidance might supplant much of the salvaging now necessary on the part of the orthodontist and simplify the placing of artificial restorations by the dentist. Preventive orthodontics should include the prevention and correction of incipient deformity by elimination of the aetiologic factors, and by the application of simple interceptive or early remedial treatment. If this be true, then the dentist wishing to include such service in his practice must be able to:—

1. Recognise incipient deformity.
2. Understand the aetiology of deformity.
3. Institute preventive measures, and
4. Perform simple corrective measures."

I have quoted this so frequently of late that you may be rather tired of it, but I am convinced that in this paragraph we have the complete answer. Any National Dental Health scheme in this country will fail if it does not commence with the pre-school age child and work upwards and, in addition, the Government should insist that every operator employed in such a scheme must have as a minimum the orthodontic knowledge set out by Brauer. In ten years the resultant reduction in the number of malocclusions would be dramatic.

To recognise incipient deformity one must be completely familiar with normal occlusion and understand something of the Angle classification of malocclusion.

To understand the aetiology of deformity will require a basic knowledge of heredity in its application to orthodontics, something of the process of evolution, and familiarity with the fundamentals of the newer knowledge of the growth and development of the skull and jaws from birth to adolescence. In addition, the operator must be fully cognisant of all the various local aetiological factors which may produce malocclusion.

With this as a background, he is in a position to be able to judge the cases in which he can institute simple preventive measures with some hope of success. Without this knowledge he can neither judge the time nor the advisability of suggesting interference; he will in many instances completely overlook developing malocclusion, or leave it until it is too late for preventive measures to be successful; even worse, he may select a case that is totally unsuitable for simple appliances and, failing to obtain a successful result, will not bother to try again, condemning the system rather than himself.

Older practitioners may say that their orthodontic training did not give them sufficient background to be able to do all this, but present-day orthodontic teaching—at least in the Melbourne School—is designed to do just this thing. The use of fixed appliances is now regarded as post-graduate work, and anyone who desires to practise orthodontics as a specialty must be prepared to give up the time necessary for post-graduate study. Nevertheless, so much has been written and talked about preventive orthodontics for so many years, that everyone must at some time or other have heard or learned something about it. Complete ignorance of the subject cannot be truly accepted as a reason for the failure to apply even the simplest preventive measures.

Therefore one begins to look further afield for the reason, and in discussing this question, as I have done on many occasions with fellow practitioners, I have often heard it said, "I do not think it worth while!". Worth while to whom? Not worth while for the patients in that it produces no results? Or not worth while for the dentist because he makes no money out of it? We know that in many cases it is well worth while for the patients—we have already seen that.

The second question is not so easily settled because the value of a practice means different things to different people. Some judge a dental practice only by the intrinsic gain to their pockets, others by the amount of service they are able to render to the public by that means. Surely the ideal is a combination of the two. One may find that there is a certain reluctance on the part of the public to pay for something that produces no tangible results at the time, but

is it not a matter for the dentist to sell this service to his patients? You cannot expect them to spend money unless they are convinced that they will receive full value in return. The dentist's reply to this is that he has no time to spend in converting his patients to the need for such service, and to a certain extent this is true—perhaps in fact he should not need to convert his patients. We should have a more adequate and enthusiastic organisation controlling the dental education of the public; then there would be no need to sell preventive orthodontics, the public would demand it. This may be the best way to solve our problem, because then the dentist who is not prepared to provide such service will soon become unpopular with those who demand the best dentistry for their children.

But the public are still very ignorant. We seek to impress on them the importance of the deciduous teeth and of the disaster which follows their early loss. Do you not think that some of the mouths I have shown you would impress them? We need to show parents the type of malocclusion which follows thumb-sucking and lip-biting, and the open bite which develops from lisping or tongue-biting. We need to tell them that any protrusion or retrusion of the mandible should be corrected as soon as possible, and we need to stop the general practitioner from telling parents that this type of malocclusion will correct itself, because it will not. All that and more needs to be told again and again through lectures to Mothers' Clubs, Meetings of Country Women's Association, and Baby Health Centres. Frequent talks on the radio would be very beneficial but they would need to be well written and repeated frequently.

Public education of any kind costs money, and it is pleasing to note that one of the main planks in the National Dental Scheme put forward by the Australian Dental Association is that of public dental health education. The point about all preventive medicine is that it is not spectacular, and for that very reason it is difficult to convince a Government of its importance. But this alone will not suffice. In addition we will need patience, tolerance, understanding and sincerity of purpose. With this, mix a full knowledge of dentistry for children and a sincere desire to do the best for the patient and then will Preventive Orthodontics indeed become a practical possibility.

THE RELATIVE MERITS OF PORCELAIN AND ACRYLIC TEETH*

ALAN R. DOCKING, M.Sc. (MELB.), A.A.C.I.†

Recently in the British House of Commons the following question was directed to the Minister for Health[1], "Is the Minister aware that some dentists use plastic teeth for permanent dentures; and would he advise against this practice on the grounds that the teeth stain and wear away in a short time?"

The purpose of this paper is to clarify the type of misconception suggested by this question by giving some factual data on the properties of porcelain and acrylic resin and how they compare with the natural hard tissues. To complete the picture with clinical data there will follow a summary of the replies to a questionnaire circulated to the members of the Panel of Co-operating Practitioners appointed by the Standards Committee of the Australian Dental Association.

Porcelain teeth have a long tradition behind them, having been introduced 150 years ago as a welcome alternative to the unwholesome activities of battlefield prowlers and "resurrectionists" in their search for human teeth. Acrylic teeth are not yet in their teens, but nevertheless have become well established for, in this country alone, there are several factories engaged in their production two at least of which can boast of an output of some 2 million teeth per year. Yet porcelain teeth have by no means been displaced; some estimate that they are still favoured in the U.S.A. in a ratio of 3 to 1.

There are, however, two significant trends. Several long-established porcelain teeth manufacturers are now producing a line of plastic teeth as well, and are paying more and more attention to their advertisement. Secondly, intensive efforts are being made to overcome that property which is commonly regarded as the greatest disability of acrylic resins, their comparative softness, and at the same time lessening their susceptibility to attack by organic solvents. Some astonishing claims have in fact been made in advertising literature but preliminary tests suggest that they cannot be substantiated. There is little justification for excitement about increased hardness until this property can be shown to equal at the very least that of dentine. Even this seems to be a long way off just at present although valiant atempts are in progress. We can only hope that research will produce the desired results in the near future.

Some facts about artificial teeth. There is little necessity to go into details as all are familiar with the general properties of both types of material. The best way of recapitulating is to give a table of comparisons. In Table I round figures are given which may be taken as typical of the better quality products.

What do these figures signify? In the first place specific gravity means little practically. Any weight advantage gained by porcelain for the lower

*Read at the Twelfth Australian Dental Congress, Sydney, August, 1950.

†Commonwealth Bureau of Dental Standards.

1. Questions in Parliament—Dentures: B.D.J., 88:197, 1950.

denture is lost in the upper. Hardness, however, is of paramount importance and will be discussed more fully later. Note the wide range of hardness; it is obvious that a compromise or average between the porcelain and acrylic materials would be almost ideal.

TABLE 1.

Property	Porcelain	Acrylic Resin	Natural Teeth	
			Enamel	Dentine
Specific gravity	2.3	1.2	2.9	2.2
Hardness (B.H.N.)	420	25	250	55
Modulus of rupture (f.p.s. units) ...	8000	11000	—	—
Thermal co-efficient of expansion ...	4×10^{-6}	80×10^{-6}	11×10^{-6}	8×10^{-6}

The higher modulus of rupture of acrylic resin indicates that although the resin is softer it is tougher than porcelain. It takes more energy to break an acrylic specimen than it does for the relatively brittle porcelain. The impact strength of acrylic resin is correspondingly greater. The thermal co-efficient of expansion is not of much interest in regard to teeth but for acrylic crowns and bridgework repeated changes in temperature may tend to break the cement seal owing to the large difference between the expansions of acrylic resin and natural tissues.

Opinions about artificial teeth. Next we shall list the general properties of porcelain and acrylic resin teeth; here we are not on quite so firm a ground for some claims may be disputed. Table 2 shows how the protagonist for porcelain might picture things.

TABLE 2.

Porcelain Teeth.	Acrylic Teeth.
High surface hardness assists trituration of foods.	Reduced masticatory efficiency due to low surface hardness and increased wear.
Permanency of form and colour.	Tendency to cold flow under heavy stress of mastication.
Inertness to oral fluids, foods, medicaments, etc.	Changes in dimensions with moisture absorption. Affected by organic solvents. Chewing gum adheres. More staining from tobacco and medicaments.

On the other hand those favouring methyl methacrylate might list the properties as shown in Table 3.

TABLE 3.

Porcelain Teeth.	Acrylic Teeth.
Brittle.	Resilient.
Friability leads to chipping.	Tough, do not chip.
Noisy.	More natural feel to patient.
Pockets form in denture base around teeth providing a "bacterial pantry."	Better bond between teeth and acrylic denture base.
Complex technique for individual teeth.	Simple method for individual tooth reproduction. Blend better with natural teeth.
Grinding removes surface glaze.	Ease in grinding and polishing.

Several so-called advantages of acrylic teeth have not been included as they appear to have no clinical support and moreover are sponsored almost exclusively by people associated with the trade. Such factors claimed are reduced traumatic shock, reduced alveolar bone absorption and reduced wear of natural teeth when opposing artificial teeth. These criticisms of porcelain teeth are apparently without foundation where the denture has been properly designed and the occlusion is correct[2].

Hardness. As the property which has been most discussed is that of hardness let us look at some facts.

(1) Porcelain is much harder than tooth enamel while acrylic resin has a lower indentation hardness than dentine.

(2) Dental methyl polymethacrylate is already substantially free from plasticiser so that no hardness gain can be expected by altering this factor or by the addition of other organic modifiers.

(3) Acrylic teeth if fully polymerised are at the maximum hardness that can be obtained using methyl methacrylate alone.

(4) Methyl methacrylate is the hardest of the family of acrylates. Ethyl polymethacrylate, methyl polyethacrylate, etc., are not as suitable so there is little hope in choosing others within this chemical family.

(5) The addition of inert fillers gives little or no improvement in hardness; in fact they often reduce the wear resistance.

(6) Hardness is not necessarily the best criterion of wear. Resistance to wear depends on the type of wear, for example, a sand blast which wears through plate glass in a few minutes will merely etch acrylic sheet in the same time.

(7) Wear-testing machines are notoriously unsatisfactory for comparing materials as different as porcelain and acrylic resin. The most promising type of wear machine appears to be one, developed by a manufacturer, in which the teeth, artificial or natural, impinge in various ways on other teeth in a bath of saliva or other fluid.

2. Seth, S. B.—Evaluation of porcelain and acrylic as a replacement of natural teeth, D. Mag. & Oral Topics, 65:259-64, 1948.

(8) Improvement in hardness of plastic teeth must be looked for in new resigns replacing or modifying methyl methacrylate. Most of the copolymers of methyl methacrylate are either softer or too brittle. A plastic tooth with a hard outer cover simulating the natural tooth has been suggested[3] and this idea has definite possibilities.

(9) While any improvement in hardness by copolymerisation or otherwise is a step forward, an increase of only 5 or so Brinell hardness units is scarcely enough to mean the outmoding of all other plastic teeth, as some advertisements seem to suggest.

(10) The ultimate answer is a clinical one. Although clinical tests are largely subjective and are difficult to assess owing to the great variety in patients, reliable information must be eventually gained by careful observations on a statistical basis.

In this regard the results of the questionnaire referred to at the outset of this paper are of interest.

Clinical project. A questionnaire (see Appendix) was circulated to the A.D.A. Standards Committee of Co-operating Practitioners numbering about 50 distributed throughout all States of the Commonwealth and, at the time of the preparation of the statistical data now under consideration, 35 replies had been received. These represent only 1 per cent. of the profession but it is felt that a fairly good cross-section of the current opinion of the dentists in this country has been obtained.

Looking at the first question of Co-operative Project No. 3 (Appendix), practitioners were asked to state their preference for either porcelain or acrylic resin according to five typical applications. The results taken over the applications as a whole represent almost exactly equal preference. Taking the individual applications, however, it is obvious that for certain types of work there is a definite preference. The diagram (Fig. 1) shows the percentage preferences for porcelain and acrylic resin. The lower plain areas indicate that preference was given for the particular material without qualification, whereas the hatched area indicates the choice was made with some reservations; perhaps for certain designs or for certain oral conditions exceptions would be made.

The results clearly indicate that, whereas for full denture work there is slightly greater preference for porcelain, acrylic resin is much more in demand for partial dentures. For facings and particularly jacket crowns porcelain is definitely favoured.

It is interesting to examine the reasons for the choice of acrylic or porcelain which were given in reply to question (b). It will be seen from Figure 2, where the areas shown are proportional to the number of dentists giving the particular reason, that the most frequent reason for the choice of porcelain teeth is for their permanence, including resistance to abrasion and to staining. Some favour porcelain on account of appearance and the fact that metal backings do not show through; others refer to a better function and the greater ease of cleaning

3. Shapiro, M. S.—Improved acrylic teeth based on a new structural and chemical concept: D. Items of Interest, 70:596-9, 1948.

margins. Although porcelain teeth and acrylic teeth are about equal in popularity those who advocate the latter are more definite in giving reasons for their choice. The greatest individual reason is that fractures are less frequent

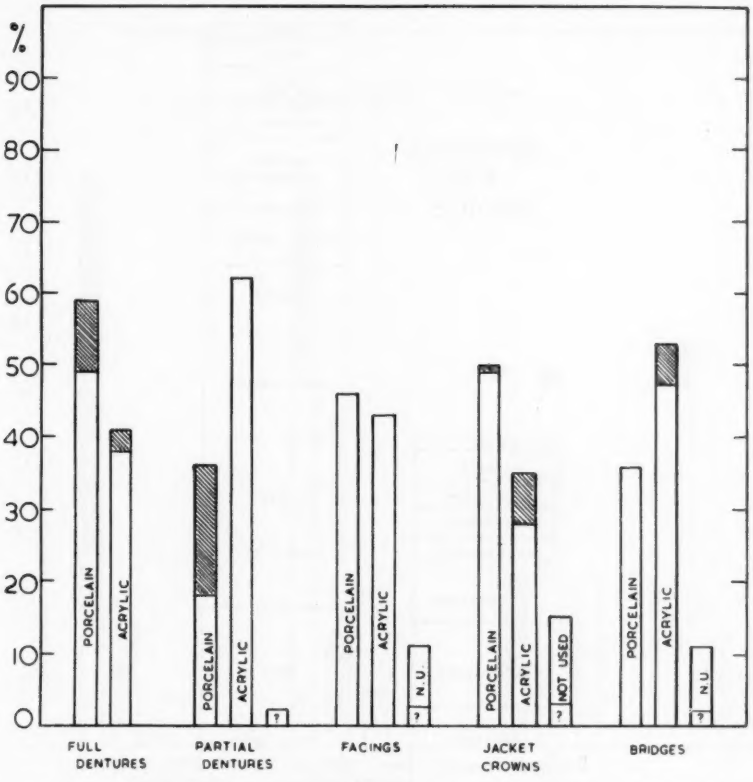

Fig. 1.—The percentage preferences for porcelain and acrylic resin teeth in the manufacture of various types of prostheses.

with acrylic teeth. Another popular reason is that colour matching is easier with acrylic resin. Others put appearance and the ability to shape the teeth, for instance, where narrow posteriors are required. Some indicate that close bites are easier to deal with and others that there is less trauma to bad bridges and a greater suitability for older patients. Other minor reasons for choice are indicated.

The next part of the questionnaire was to determine how well-founded were the various criticisms frequently made against either porcelain or acrylic teeth. Figure 3 indicates that most of the dentists have experienced trouble with the breakage of porcelain teeth during fabrication although the majority of the

affirmative replies were qualified in some way, i.e., they had only experienced breakage during fabrication with certain types of teeth or for some other reason. A similar type of result was obtained for the breakage of porcelain teeth during wear.

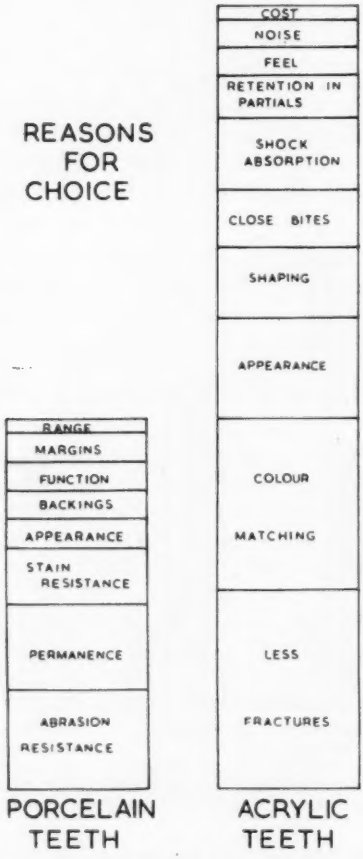

Fig. 2.—Diagrammatic representation of the reasons given by dentists for their choice of porcelain or acrylic teeth. Areas shown are proportional to the number of dentists giving the particular reason for choice.

In regard to the formation of "pockets" between porcelain teeth and acrylic resin the evidence is that there are few complaints from this point of view. Quite a few were doubtful in their reply to this question as indicated on the diagram. Some dentists have claimed that these pockets provide "bacterial pantries" and are therefore objectionable. Other criticisms of porcelain teeth are shown in Figure 4.

In reply to question (d) regarding criticism of acrylic teeth a slight majority of dentists indicate that they have difficulty in cleaning gingival margins (Fig. 5). Only a few claim that acrylic teeth are difficult to grind into occlusion.

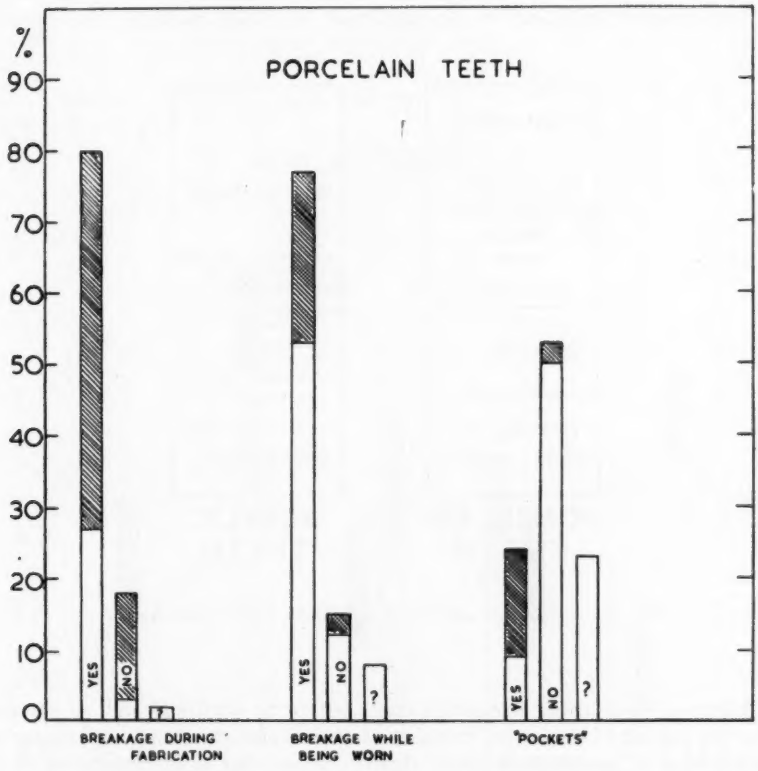

Fig. 3.—Diagrammatic representation of the number of dentists experiencing trouble with porcelain teeth under different conditions.

When we come to the important point regarding the hardness of acrylic teeth it is found that the clinical evidence for wear is not very strong. Thirty-eight per cent. say that they have no evidence of excessive wear and another 18 per cent. give a negative reply with some qualification. Only 23 per cent. definitely state that they have evidence of excessive wear.

In the case of discolouration of acrylic teeth the results confirm that this factor is an important one although opinion is fairly evenly divided numerically. The majority of dentists do not experience trouble through the "crazing" or "checking" of acrylic teeth during wear. Many of their answers are qualified

by statements such as no crazing is experienced if care is taken to avoid the use of organic solvents.

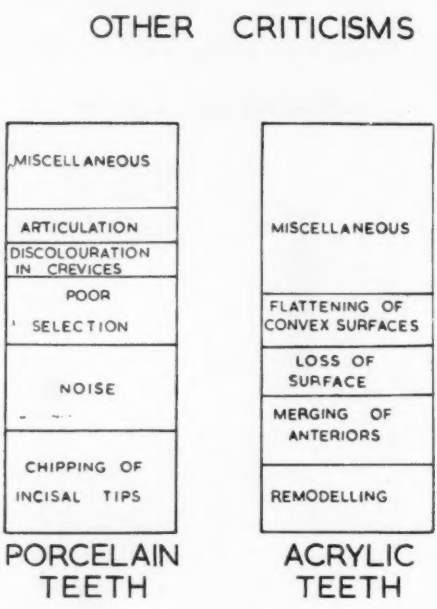

Fig. 4.—Criticisms offered of porcelain and acrylic teeth.

Figure 4 shows other complaints made regarding acrylic as well as porcelain teeth. In regard to the latter, chipping of incisal tips, the "clicking" noise, and poor selection of moulds were major items. Some refer to discolouration in the crevices between the teeth and the denture base after a time, and there are miscellaneous objections such as difficulty in cutting the face of porcelain teeth because of loss of gloss, changes sometimes occurring in articulation, and the ease of "chewing off" anteriors from acrylic bases. With acrylic teeth the inability to re-model a denture is mentioned and the observations that the anterior teeth tend to "merge" during processing, or when seen at a distance there is a "blurring" of the anteriors.

Other objections to acrylic teeth include the flattening of convex surfaces, discolouration around gingival margins after some time, loss of surface characteristics through cleansing, softening by oil of cloves and ineffective mastication. Some dentists point out that with acrylic jacket crowns there is a tendency for the gingival margin to separate. Some also find that irritation occurs where crowns contact the gum tissues.

Conclusion. These data illustrate the danger of making dogmatic statements about the use of artificial teeth. Two conclusions stand out:—

(1) Neither porcelain nor acrylic resin is the ideal tooth material but something intermediate in properties would be desirable.

(2) The choice of porcelain or acrylic teeth depends largely on the particular circumstances. In some cases either may be used, in others one is to be preferred. A knowledge of their properties and of their behaviour to be expected under the particular set of conditions will decide.

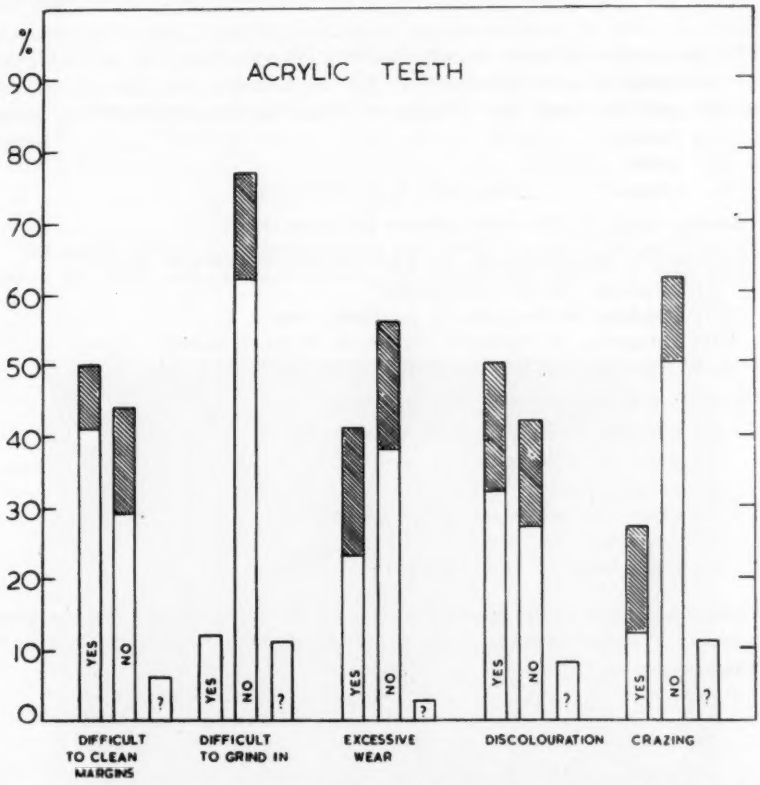

Fig. 5.—Diagrammatic representation of the difficulties experienced by dentists in relation to the use of acrylic teeth.

Acknowledgments.

I am grateful to the Standards Committee of the Australian Dental Association and the Co-operating Practitioners who have willingly assisted in providing information and advice. Thanks are also due to members of the staff of the Bureau who prepared the illustrations.

APPENDIX.

Porcelain or Acrylic Resin.

Co-operative Project No. 3.

Much has been written for and against acrylic resin as an alternative for porcelain for use in artificial teeth, crowns, and other restorations. Porcelain has been criticised on the ground of bitterness, hardness, etc., and acrylic resin because of relative softness, discolouration, etc.

It would be appreciated if, as a Co-operating Practitioner, you would express the results of your experience by completing this questionnaire as far as you are able.

(a) Do you prefer porcelain or acrylic resin for use in—

- (i) artificial teeth for (acrylic) full dentures? .....
- (ii) artificial teeth for (acrylic or metal) partial dentures? .....
- (iii) facings? .....
- (iv) jacket crowns? .....
- (v) bridges? .....

(b) Briefly, what are the chief reasons for your choice? .....

(c) In regard to porcelain teeth, have you experienced trouble due to—

- (i) breakage during fabrication? .....
- (ii) breakage while dentures are being worn? .....
- (iii) formation of "pockets" in acrylic denture bases? .....
- (iv) other faults? (Please name.) .....

(d) In regard to acrylic resin have you noted—

- (i) difficulty in cleaning gingival margins? .....
- (ii) difficulty in "grinding in" or "milling in" the occlusion? .....
- (iii) excessive wear? .....
- (iv) discolouration or alteration of shade? .....
- (v) "checking" or "crazing"? .....
- (vi) other faults? (Please name.) .....

Note: In regard to discolouration of acrylic resin teeth, it would be greatly appreciated if actual examples could be retained and forwarded to this Bureau for examination.

ADAMANTINOMATA: A BRIEF DISCUSSION OF THEIR PATHOLOGY WITH A REPORT OF THREE CASES*

D. A. CAMERON.†

Adamantinomata are rare tumours and consequently there are differences of opinion concerning their nature. There are several other names used to describe them and, of these, ameloblastoma is used almost as frequently as adamantinoma. Neither term is satisfactory as on the one hand adamantinoma suggests the formation of enamel and this is a very rare occurrence; on the other hand there is no agreement as to the histogenesis so that the use of the name ameloblastoma, meaning a tumour of ameloblasts, is also not justified. Adamantinoma has been adopted here only because it is the older name. Other terms in use are adamantoblastoma and epithelial odontome; and Willis[1], who regards these growths as malignant, suggests "carcinoma of the tooth-germ residues."

DESCRIPTION OF THREE CASES.

Case 1.

The patient was a man aged twenty years with a history of swelling of the angle of the right side of the mandible for two months and pain more recently.

Fig. 1.—Radiogram showing a cyst enclosing the crown of the lower right third molar tooth. Case 1.

*Read at the Twelfth Australian Dental Congress, Sydney, August, 1950.

†From the Department of Pathology, University of Sydney and the Institute of Dental Research, Sydney.

1. Willis, R. A.—Pathology of tumours, London, Butterworth & Co. Ltd., 1948, p. 315.

On examination there were found enlargement of the bone with tenderness on pressure and ulceration of the overlying mucosa. The radiographic examination showed a cyst enclosing the crown of the lower right third molar tooth (Fig. 1).

The cyst was enucleated and the tooth and some tissue near the cyst wall were removed.

Naked eye examination: The specimen consisted of a collapsed cyst 2.5 cm. in diameter and a piece of firm, yellow tissue. The outer surface of the cyst was smooth and some of the inner surface was irregular.

Microscopical examination: The cyst was lined for the most part by several layers of polyhedral epithelial cells but in one place there was a mass of tissue with an appearance typical of adamantinoma. There were masses and cords of epithelium forming an irregular network set in a stroma of myxomatous tissue. The epithelial cells were columnar or cuboidal with pale cytoplasm and dark purple nuclei. Those outlining the masses were in the form of a palisade but the central cells were stellate and arranged loosely in a network (Figs. 2 & 3).

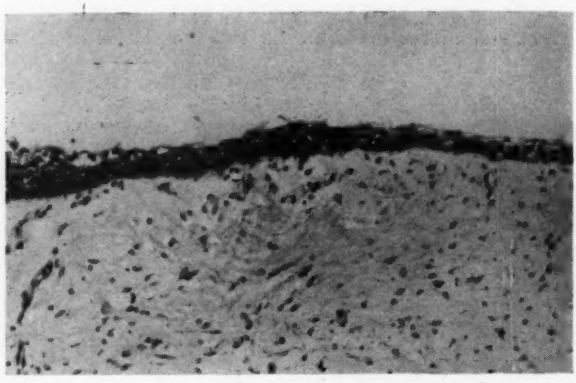

Fig. 2.—Photomicrograph of part of the cyst wall showing the polyhedral cells in the epithelial lining. Case 1 x 125.

Diagnosis: Adamantinoma developing in a dentigerous cyst.

Case 2.

The patient was a woman aged twenty-seven years. Three weeks before examination she had noticed a painless swelling in the bicuspid and molar region on the right side of the lower jaw.

The radiographic examination showed a cyst involving the roots of the lower right third molar tooth and extending to the lower border of the right mandibular canal. The appearance was that of a radicular cyst. The other molar teeth on the right side were missing (Fig. 4).

Microscopical examination: The main cyst was lined by several layers of flattened epithelial cells. In one part of the cyst wall there were several smaller cysts which had a basal layer of columnar cells supporting several layers of loosely arranged stellate cells. There were also small masses of epithelium, having a layer of columnar cells surrounding cells resembling the stellate reticulum of the enamel organ. In some areas there was early cystic degeneration among the stellate cells. The stroma varied from dense collagenous to loose and cellular connective tissue (Fig. 5).

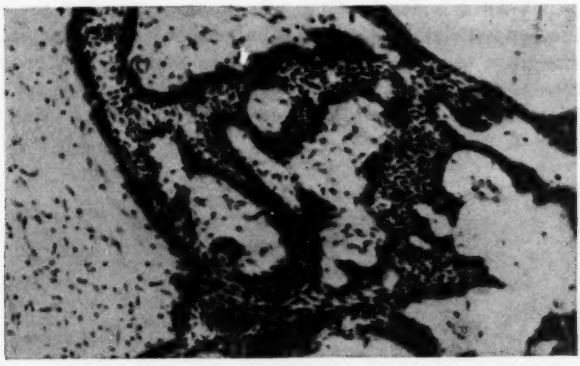

Fig. 3.—Photomicrograph showing the adamantinomatous structure of the mass of tissue in the cyst wall. Case 1 x 125.

Diagnosis: Adamantinoma.

Case 3.

The patient was a woman aged sixty-five years. In November, 1941, a cyst extending from the lower left cuspid tooth to the lower right first molar tooth was removed. The cyst recurred and was again removed in May, 1946. Histopathological examination was not carried out at either time.

In October, 1949, the patient complained of swelling and pain in the same region. On examination there was a firm swelling between the lower left cuspid and lower right first molar teeth. A radiogram showed loss of bone in the area of the swelling and erosion of the adjacent portions of the mandible (Fig. 6).

Microscopical examination of a biopsy specimen showed many small groups of epithelial cells invading connective tissue. The cells showed some anaplasia but were mostly columnar or cuboidal with darkly staining purple nuclei and deep pink cytoplasm. There were some larger masses of cells and one or two of these had a centre of branching cells suggestive of adamantinoma. The provisional diagnosis was that this was a malignant epithelial new growth (Fig. 7).

The tumour with some bone at each end was later removed.

Naked eye examination: The specimen measured 5.0 x 3.5 x 2.5 cm. and had puckered mucous membrane on one surface. The other surfaces showed muscle, fascia and adipose tissue; a small piece of the mandible was present at each end of the specimen, the bulk of which was composed of uniformly firm, pale cream-coloured tissue.

Microscopical examination: The greater part of the section was composed of irregularly shaped masses of epithelium lying in a stroma which was scanty and composed of fairly densely packed collagen fibres. Each of the masses had an outer border of cuboidal or short columnar cells with vesicular nuclei and pale pink, vacuolated cytoplasm. The cells in the centre of the masses were loosely arranged and stellate in shape but had the same staining properties. At the edge of the main tumour mass, groups of cells similar to those seen in the biopsy specimen were found invading the stroma which was more cellular than elsewhere. Mitotic figures were to be seen in the epithelium in all parts of the section (Figs. 8 & 9).

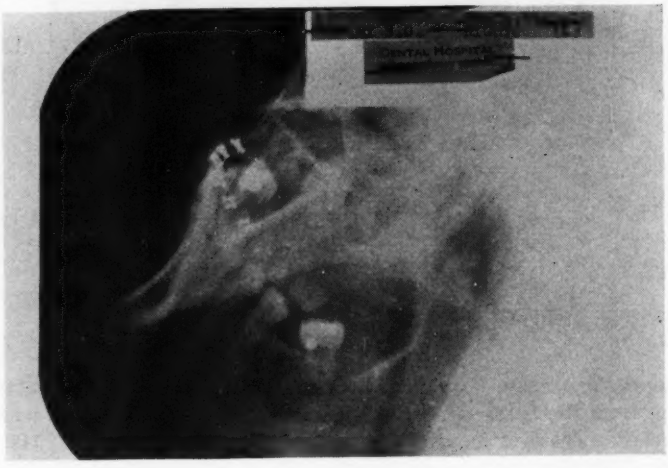

Fig. 4.—Radiogram showing a cyst involving the roots of the lower right third molar tooth. Case 2.

Diagnosis: Adamantinoma showing malignancy.

The patient later died. No metastases were found at the post-mortem examination.

Discussion.

The adamantinoma is a slowly growing tumour usually appearing first as an enlargement of the body of the jaw, occurring at any age but more commonly

between the ages of ten and thirty-five years. Robinson[2] reported that the average age at which the patient first noticed the tumour was thirty years and the time before seeking attention was 8.5 years. The three tumours described in this paper occurred in the mandible which is the bone most commonly involved.

Description of the appearance of the adamantinomata.

Naked eye appearance: Very early discovery and examination of these tumours is unusual, so that their appearance when they first arise is mainly a matter for conjecture. However, the two cysts described in this paper were examples of adamantinomata in a fairly early stage of development and may throw some light on the subject. In Case 1 the clinical and radiographical examination indicated the presence of a dentigerous cyst. During removal the cyst stripped cleanly away from the surrounding bone but there was a small mass of tumour tissue outside the cyst wall. The cyst was found to have some irregularities on the inner surface of its wall but no secondary cysts were visible.

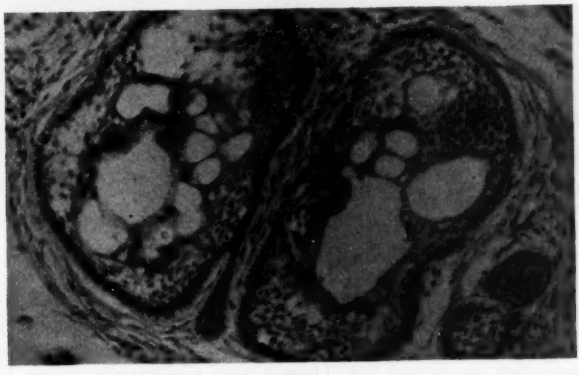

Fig. 5.—Photomicrograph showing some of the small cysts in the main cyst wall. Case 2 x 125.

In Case 2 radiographical examination revealed a cyst lying in the body of the right side of the mandible and involving the roots of the third molar tooth on that side. The other molar teeth were missing.

The radiologist diagnosed the lesion as a radicular cyst and this seemed to be substantiated by the appearance of the cyst during its removal.

The larger tumours commonly contain many cysts but solid tissue may make up the bulk of the growth. The lining of the cysts may be smooth or have irregular papilliform projections from the inner surface. Some of the larger tumours have a single large cavity with the wall honeycombed by small secondary cavities.

2. Robinson, H. B. G.—Ameloblastoma. A survey of 379 cases from the literature, Arch.Path., 23:831, 1937.

The tumours are usually well circumscribed: even the very large ones commonly have a covering of bone and extension into the neighbouring soft tissues is a rare occurrence.

Case 3 in this paper demonstrates a solid type of tumour in which there was a great overgrowth of fibrous tissue. No cysts were visible and there was no bony capsule around the tumour.

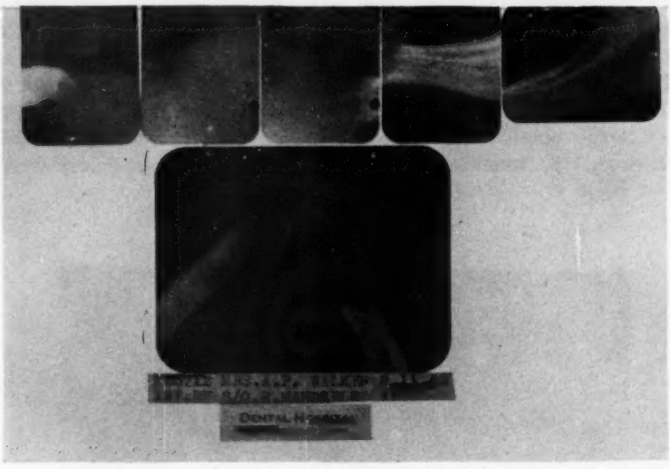

Fig. 6.—Radiogram demonstrating the absence of bone in the area of the tumour. Case 3.

Microscopical appearance: The usual microscopical picture of adamantinomata has been well described by Thoma and Goldman[3]: "The tumour may appear solid, cystic, or a combination of both. If solid, it is composed of cords or strands of epithelium growing in a connective tissue stroma, or occasionally almost without a stroma. The epithelial cords, which may form a network or take on a papillary structure, may resemble the anlage given off from the dental lamina and have a similar tendency to form small buds comparable with the earliest stage of the enamel organ. In the central portion of the cord or lobule the epithelium appears stellate, like the stellate reticulum of the enamel organ; in the periphery the cells are cuboidal to cylindrical.

"The cystic type is characterised by lobules or strands of adamantine epithelium with a peripheral layer of cylindrical cells which, in structure, approach ameloblasts. These cells lie on a basement membrane. The central portion consists of stellate to squamous epithelium undergoing cystic degeneration. Pressure of cystic fluid causes these spaces to enlarge; they often fuse and communicate with one another."

3. Thoma, K. H., and Goldman, H. M.—Odontogenic tumours, Amer.J.Path., 22:433, 1946.

In each of the tumours in this series, tissue was found which had a microscopical appearance similar to some of these variations described by Thoma and Goldman.

In Case 1 the cyst was lined for the most part by several layers of polyhedral epithelial cells (Fig. 2) but in some areas there were masses of cells of a different appearance. Each had an outer layer of columnar or cuboidal cells surrounding a centre of branching cells (Fig. 3). The stroma appeared mainly myxomatous.

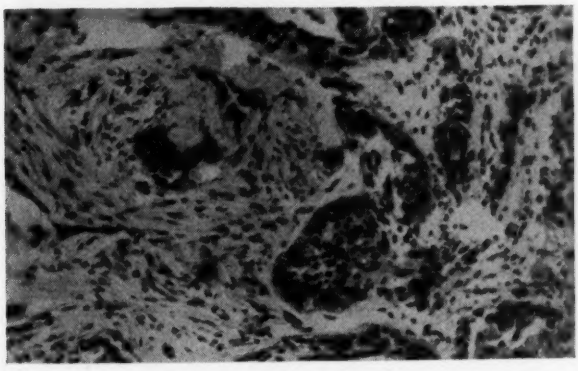

Fig. 7.—Photomicrograph showing a section from the biopsy specimen. Case 3 x 125.

The occurrence of an adamantinoma in association with a dentigerous cyst is not uncommon and Cahn[4] has taken the view that all dentigerous cysts should be regarded as potential adamantinomata, even though the usual lining were stratified squamous epithelium. He thought this view was justified as there were numerous reports of dentigerous cysts, in which was found mural tissue having an adamantinomatous structure.

In Case 2 the cyst was not dentigerous and its origin is uncertain. The greater part of its wall was covered by a layer of flattened epithelium but one section contained several small cysts (Fig. 5). There were also several collections of cells composed of an outer columnar layer surrounding cells resembling the stellate reticulum of the enamel organ. Early cyst formation was seen in the centres of some of the groups.

The main bulk of the tumour described in Case 3 was made up of epithelium (Figs. 8 & 9) having a resemblance to the arrangement already noted in the other two tumours. The tumour must be classed as malignant and this may explain the variation from the classical picture. The small groups of cells invading the connective tissue (Fig. 9) might have suggested that the tumour was an anaplastic squamous carcinoma but there was nothing else to support such a diagnosis.

4. Cahn, L. R.—The dentigerous cyst is a potential adamantinoma, Dent. Cosmos, 75:889, 1933.

Histogenesis.

According to Diamond[5], the development of the epithelial elements involved in tooth formation starts with a proliferation of some of the basal cells of the oral epithelium to form the dental lamina. From this the individual tooth buds penetrate the underlying tissue and each forms a cap-shaped mass composed of two layers of cells; those on the convex surface are cuboidal and those on the inner surface columnar. These columnar cells are the developing ameloblasts. The two layers separate, the intervening area becomes filled with proliferating stellate cells and the bell-shaped structure which forms is the enamel organ.

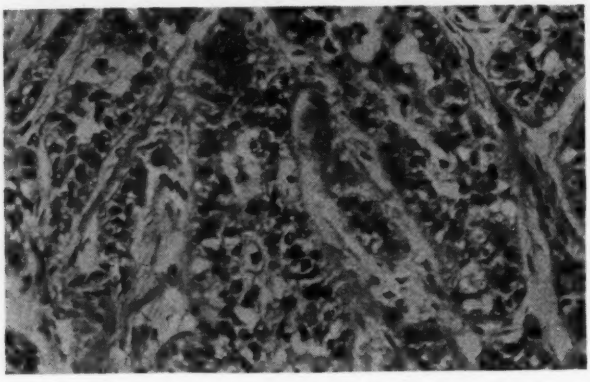

Fig. 8.—Photomicrograph showing the structure of the greater part of the tumour. The epithelial cells appear columnar or cuboidal and mitotic figures are present. Case 3 x 175.

The dentine develops from the primitive mesenchyme which invaginated the enamel organ. It is moulded into shape to form the root by a further proliferation of the cells of the inner and outer layers of the enamel organ. On completion of this function, this epithelial tissue—the sheath of Hertwig—becomes fenestrated and islands of epithelium are left in the periodontal membrane. Other sources of aberrant epithelium in the alveolus are the auxillary buds starting from the oral epithelium, the dental lamina and the external surfaces of the enamel organ. The epithelium may persist until adult life as the epithelial debris of Malassez[6].

The potentialities of the embryonic oral epithelium to produce such a variety of epithelial cells adequately explains the variations seen in the adamantinomata.

It has come to be accepted that the typical adamantinoma contains lobules

5. Diamond, M.—Oral histology and embryology. Ed. by Orban, B., St. Louis, Chapt. III. Enamel. B. Development, p. 80, 1944.
6. Malassez, L.—Sur l'existence d'amas epitheliaux autour de la racine des dents chez l'homme adulte et a l'etat normal (debris epitheliaux paradentaires), Arch.Phys., Feb. Abs., 1885, Brit.Dent.J., 6:370, 1885.

of tissue which have a reasonably close resemblance to the enamel organ, an appearance which is consistently encountered elsewhere only in some tumours of the pituitary gland. Those described in other situations, such as the tibia, are rare and not typical examples of tumours derived from stratified squamous epithelium. Thus it would seem that the tumour arises during tooth formation or is derived from an embryonic remnant rather than a proliferation of the mature oral epithelium.

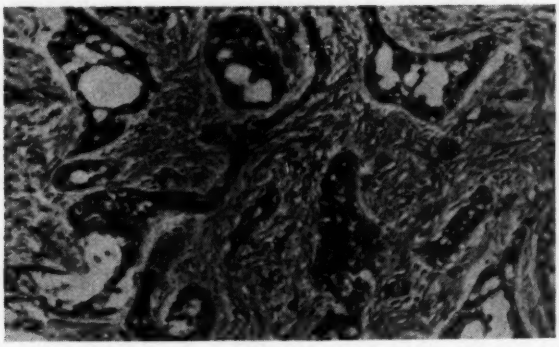

Fig. 9.—Photomicrograph showing small groups of anaplastic cells invading the connective tissue surrounding the tumour. Case 3 x 125.

Most writers regard the epithelial debris of Malassez as the most likely site of origin, and the age at which the tumour first becomes apparent suggests that it arises after tooth formation is complete. However, the fact that some tumours have been found associated with unerupted third molar teeth, as in Case 1 in this series, suggests that they may also arise directly from the enamel organ. The view that the enamel organ alone is the starting point is held by Zegarelli[7] who examined tumours in the jaws of a number of mice. In 58 mice with 97 adamantinomata, only five tumours were in mice in which epithelial rests were observed in the periodontal membrane. All these rests were inactive. On the other hand, 89 of the tumours unquestionably arose from the enamel organ, and almost certainly from the external enamel epithelium.

Ringertz[8] believes that, when an adamantinoma lies superficially in the alveolar process, there is generally connection with the surface epithelium giving a decided impression that the tumour arose from that site.

Malignancy.

In many reports in the literature the tumours have been regarded as benign. They grew slowly, were fairly well circumscribed and rarely infiltrated the soft

7. Zegarelli, E. V.—Adamantoblastomas in the Slye stock of mice. Amer.J.Path., 20:23, 1944.
8. Ringertz, N.—Pathology of malignant tumours arising in the nasal and paranasal cavities and maxilla. Acta Otolaryngologica, Supplement 27, p. 83, 1938.

tissues or gave rise to metastases. These were characteristics of the tumours described in Cases 1 and 2.

Despite these features infiltration of the surrounding bone and recurrence is common and on this account Willis states that the tumours are malignant. In Robinson's paper[2], of the 379 tumours recorded, 119 recurred after removal and numerous writers, more recently, have noted the same behaviour. Thoma and Goldman[3] state that this frequency, rather than being an indication of malignancy, is indicative of the difficulty of removing the entire lesion by conservative operation. This, no doubt, is often the case, but Lee[9] reports a tumour recurring six times over a period of thirteen years, with a change in the histological appearance from that of typical adamantinoma to one suggesting malignancy. In Rattner's series[10], 16 of the 21 tumours recurred and he considered that there was evidence of increasing malignancy following removal.

Case 3 gives the impression that there was an increase in the activity of the tumour cells since the time of the first operation, though a histological examination was not made at that time. The tumour was almost certainly an adamantinoma but there are several reasons for stating that it was not benign but malignant. There was no surrounding plate of bone and the tumour extended into the soft tissues. The bone of the mandible was being eroded. Microscopically there were cells showing a moderate degree of anaplasia and mitotic activity and groups of them appeared to be invading the connective tissue stroma.

The formation of secondary growths is rare, and few have been reported. Simmons[11] reported two cases where there was histological evidence of secondary deposits in the regional lymph nodes after several attempts at removal of the primary growths. One patient died fifteen years after first noticing the tumour and metastases were found in the lungs. Schweitzer and Barnfield[12] reported an adamantinoma which was operated on twenty-four times and gave rise to secondary deposits in the brain and lungs, without local lymph node involvement. They reviewed all available records of malignancy and found that only six of the thirty-two tumours produced secondary growths confirmed histologically. Zegarelli[7] has found instances of adamantinomata recurring in mice and producing metastases.

Aetiology.

Robinson[2] suggests that irritation is a cause. He stated: "It seems that there may be a primordium of cells with a tendency to form the epithelial portion of the tooth-germ, which may be excited to growth by some irritating secondary factor" and found that 102 of the 379 tumours he reviewed were associated with some form of irritation.

---

9. Lee, E. S.—Adamantinoma of the lower jaw, Proc.Roy.Soc.Med., 34:323, 1940-41.
10. Rattner, N.—Adamantoblastoma: review of 21 cases, Amer.J.Orth. (Oral Surg.Sect.), 33:484, 1947.
11. Simmons, C. C.—Adamantinoma, Ann.Surg., 88:693, 1928.
12. Schweitzer, F. C., and Barnfield, W. F.—Ameloblastoma of the mandible with metastases to the lungs: report of a case, J.Oral Surg., 1:287, 1943.

With a number of tumours reported [10, 13] since Robinson's paper, there has been a history of previous tooth extraction. Jacobs[14] considered that when unerupted teeth are removed, there is a likelihood of some of the follicle remaining and suggests that the long continued pressure of eruption on this tissue may cause tumour formation.

Summary.

Three adamantinomata have been described, each one occurring in the mandible. Two of them were at an early stage of development in the wall of a cyst. Case 3 demonstrated an adamantinoma which had a history of two recurrences over a period of eight years and the patient was well past the age at which the tumours usually appear.

No further evidence was brought to light which would increase the present knowledge of the histogenesis of adamantinoma, but Case 1 supports the contention that dentigerous cysts are potential adamantinomata.

Two of the tumours showed no evidence of malignancy but that described in Case 3 must be considered malignant despite the rarity of this condition.

The history in each case does not reveal any aetiological agent.

A study of the literature reveals that the adamantinoma fulfils only one of the usually accepted criteria of malignancy, namely, infiltration with consequent recurrence after incomplete removal. Metastasis is rare, growth is slow with a history of increase in size over a number of years and there is reproduction of the structure of the enamel organ. There is no certainty about their histogenesis or aetiology.

Acknowledgments.

I wish to record my gratitude to Professor W. K. Inglis, Dr. N. E. Goldsworthy and Mr. E. Slater for their advice and assistance in the preparation of this paper.

13. Bernier, J. L.—Ameloblastoma: review of 34 cases, J.Dent.Res., 21:529, 1942.
14. Jacobs, M. H.—Etiology of dentigerous cysts, multilocular cysts, odontomas and adamantinomas, Amer.J.Orth. (Oral Surg. Sect.), 25:1190, 1939.

PRACTICAL TECHNIQUES FOR STERILIZATION*

A. J. ARNOTT, T. R. CORBETT, J. S. LYELL, E. STANLEY WALLACE.

Professor Arnott: The need for the employment of aseptic procedures in all dental techniques is now fully accepted. The avenues by which infection may occur are numerous: their elimination will be discussed in the following way:—

1. Sterilization of instruments and dressings.
2. Preparation of field of operation.
3. Techniques to be employed in the practice of operative dentistry.

The procedures to be adopted in the maintenance of asepsis involve the use of antiseptics, the most effective of which is heat. Sterilization by heat is best achieved by subjecting the object to circulating saturated steam at a temperature of 130°C. to 145°C. for fifteen to twenty minutes. The best substitute for circulating steam is of course boiling water. In a dental practice, most instruments and appliances are sterilized by the boiling method using a suitable sterilizer. However, it is clear that to sterilize only the instruments used in various dental operations will not eliminate all avenues of infection. An autoclave is an essential unit in the equipment of a dental practice. The autoclave provides the means of sterilizing gauze swabs, cotton wool, swab sticks, gowns, gloves, etc.

It must be conceded that the dental radiogram provides a means of ensuring successful dental service to our patients. Yet, not many years have passed since some practitioners ridiculed the colleague who was unwilling to diagnose carious lesions in teeth, periodontal disease, etc., without resorting to X-ray. In the like manner we can anticipate a universal acceptance of more thorough measures to combat sepsis in all dental operations. The first step in this direction is to establish as a state of common practice the acceptance of the autoclave as an essential unit of dental equipment wherever dental operations are performed.

1. STERILIZATION OF INSTRUMENTS AND DRESSING.

Mr. Corbett:

A. Steam under pressure. At least 121°C. (250°F.) for from 10 to 30 minutes.
B. Dry heat. At 160°C. (320°F.) for 1 hour.
C. Boiling water. 100°C. (212°F.) for 20 minutes.
D. Hot oil bath. 250°-300°F. for 10 to 15 minutes.
E. Cold chemical solution. At room temperature (20°C.).
F. Solutions for sterilizing skin surfaces.

A. STEAM UNDER PRESSURE.

The Autoclave. Many authorities unanimously recommend steam under pressure for sterilization in general. Fundamentally the autoclave consists of a steam supply, a sealed sterilization chamber, and a heating jacket. Steam may

*This paper was read at a meeting of the Discussion Group of the Institute of Dental Research, held at the United Dental Hospital on 12th October, 1949.

be introduced into the chamber and jacket separately or at the same time by regulating a valve.

For coagulation of micro-organisms—the process by which they are destroyed—at moderate temperature, moisture is absolutely essential: that is why steam is preferable to dry hot air. Steam contains moisture; dry hot air dissipates moisture, dehydrates material and so requires a much longer time to devitalise material.

Most operators assume that the pressure of the steam is the essential factor and that maintenance of pressure necessarily ensures the temperature required. Pressure itself does not destroy bacteria but it is required to produce the temperature necessary to do so. A pressure of 15 lb. per sq. inch, even over a long period, can mean any temperature from 212° to 250°F. in a sterilization chamber. The highest temperature that could be secured in pure saturated steam at 10 to 15 lb. per sq. inch is 240° to 250°F. (115° to 121°C.). If air is not completely evacuated from the sterilization chamber, suitable temperatures cannot be attained in any reasonable period and failure to sterilize will occur. The surest way of gauging the sterilizing quality of steam is to measure its temperature regardless of the pressure, e.g.:—

Gauge pressure lb./sq. inch	Pure steam complete air discharge	2/3 air discharge 20" vacuum	1/2 air discharge 15" vacuum	1/3 air discharge 10" vacuum	No air discharge
10	115°C 240°F	109°C 228°F	105°C 220°F	100°C 212°F	90°C 193°F

Air is more than twice as heavy as steam so will sink to the bottom of the sterilizing chamber: there is also a tendency for air and steam not to mix. It is therefore necessary to stack bundles of dressings, etc., vertically and containers horizontally to ensure that air is not trapped therein.

Action of steam sterilization. Steam heats materials, especially when porous, by rapid condensation, as opposed to slow absorption by dry heat. This is made possible by the "latent heat of steam." One pound of water requires 142 heat units to raise it from 70°F. to 212°F., then 970 heat units are required to convert that pound of water at 212°F. into steam at 212°F. A further 13.5 heat units are necessary to raise this pound of steam to 250°F. (15 lb. per sq. inch). Actually over 80% of the heat is accounted for in the latent heat.

For every pound of steam condensed surrounding objects absorb latent heat. This is important for the permeation of heat into packets of materials. Steam contacts the wrappers, which are slightly cooler, and condenses. The heat is absorbed and the moisture necessary for the destruction of organisms and spores is left. The steam then passes through this layer to the next which it wets and heats. In turn the whole mass is moistened and heated, the temperature remaining constant at that of the surrounding steam.

Drying is accomplished by releasing the pressure in the chamber whilst that in the jacket is maintained to retain heat, and then using the steam pressure

to induce a vacuum in the chamber, and/or "cracking" the door (opening slightly to create a draught). This should occupy 5 to 10 minutes.

Thus autoclaving is very useful in that it provides packages of sterile goods, which may be handled with the minimal risk of contamination, and may be stored for instant use.

Most dental requisites may be autoclaved with safety, exceptions being mechanical parts, such as handpieces.

Towels, dressings, gowns, etc., are wrapped in double muslin covers and stacked in the autoclave so that the articles stand vertically to allow easy steam penetration. Four routine sterilization packs should not exceed 12″ x 12″ x 20″. Time for these should be 30 minutes at 250°F. (15 lbs. per sq. inch).

Rubber gloves, dusted with talc and cuffs turned back with gauze pads beneath cuffs and in the hand to permit steam access, are paired in individual packets. These are stacked vertically. Time 15 minutes at 250°F.

Instruments. All surgical instruments may be autoclaved. They may be stacked on a large tray lined with a towel and covered similarly. Time for routine sterilizing of instruments is 10 minutes at 250°F. Emergency sterilization may be performed in 5 minutes, whilst perfectly clean instruments may be sterilized in 2 to 3 minutes. However, with many instruments one cannot be absolutely certain that all crusts of blood or puss have been removed from crevices or joints, so the longer time is required. Sets of instruments may be wrapped in double muslin covers ready for use. Time for these should be 15 to 20 minutes at 250°F.

Needles and scalpel blades, protected by wads of cotton and wrapped in muslin, may be autoclaved in test tubes or small jars. Tight cork or rubber stoppers must *not* be used, and the vessels should be laid down to ensure complete displacement of air by steam and drainage of condensate. Time 15 to 20 minutes.

Utensils may be wrapped individually or nested and stood on edge to permit drainage of condensed steam. Time 15 to 20 minutes.

Aqueous solutions. Distilled water for local anaesthetic solution: this should be placed in pyrex flasks not more than $\frac{3}{4}$ to $\frac{2}{3}$ full, to allow for boiling. Each flask should be closed by a paper cap either specially made for the purpose or made of three thicknesses of thin paper laid across the mouth and bound tightly to the neck with tapes secured by pins. The paper acts as a filter for the intake of air on cooling. Cotton bungs should not be used with liquids for parenteral injection, as lint or dust may be carried into the flask on cooling. Time for sterilization varies with the size and type of utensil used: if large vessel of thick glass then longer time required than for smaller vessel of thin glass (125cc. pyrex flask containing 100cc. fluid needs 8 to 10 minutes at 250°F.).

A "danger period" exists during cooling. If the steam pressure is released suddenly the liquid boils furiously and may overflow, so before opening allow 6 to 7 minutes to elapse to reduce the temperature of the chamber. Even with great care, 3 to 5% of fluid is lost by vaporization. Allowance should be made for this when solutions are being prepared.

Powders cannot be successfully autoclaved. They are best sterilized in a hot-air oven.

Pressure cookers have been suggested for autoclaving small packets.

B. DRY HEAT.

Such substances as *wax*, various *oils*, *vaseline* in any form, *talc* in bulk, cannot be properly sterilized in the autoclave because the moisture cannot be made to penetrate their mass. Organisms buried in such products will be heated to steam temperature but, lacking the moisture factor, may retain their viability. Such "sealed-in" organisms may not be released in the body for days or weeks until such time as the wax or vaseline is absorbed by the tissues.

Thermostatically controlled, electrically heated ovens are the most suitable for this process. The temperature required is 160°C. (320°F.) for 1 to 2 hours. Place in oven, close the door, turn on the heat, commence timing only when inset thermometer indicates required temperature. Gas-heated ovens are used in laboratories for sterilizing glassware, etc., where excess heat is not critical.

Talc in bulk cannot be steam-sterilized because steam cannot circulate through it. Even in a hot-air oven containers should not be large, because heat is transmitted slowly, and periods of exposure should be not less than 2 hours at 320°F. Other powders, such as monacrin and sulphanilamide, should be treated similarly.

Oils are put in small bottles or flasks, no more than $\frac{2}{3}$ full, i.e., sufficient for one use. Time 1 hour at 320°F.

Bone wax in very small containers takes 1 hour at 320°F.

Vaseline gauze, etc., in a larger mass takes 2 hours at 320°F.

Glycerine in small containers takes 1 hour at 320°F.

Hypodermic needles, scalpel blades, suture needles, glass syringes, need 1 hour at 320°F. They should be placed in muslin in a petri dish, or merely wrapped in muslin, or each, with points protected, in individual tubes with a tight cotton bung. Parts of syringes may be sterilized, separated or assembled, though in the latter breakages may occur due to unequal expansion. Scalpel blades should not be sterilized this way more than once, as temper will be destroyed: they should be autoclaved.

C. BOILING WATER. (Temperature cannot be more than 212°F. (100°C.)).

Instruments and utensils *must be completely covered* with water and period of boiling should be 20 minutes. However, where instruments have been sterilized and have not contacted infected material, re-sterilization may be effected by boiling for 10 minutes.

Instruments used on an infected wound should be immediately immersed in 5% lysol for 1 hour, to prevent spread of infection and to protect the assistant from infection, then boiled in the usual way to sterilize.

It is claimed that 1% sodium carbonate hastens destruction of organisms and the addition of this salt is recommended in all boiling, *except* where *glass syringes* are being sterilized. These must be boiled in *plain* water. Doubts exist as to whether sodium carbonate prevents rusting, but the best method of minimising this corrosion is to boil the water for 10 minutes before the instruments are inserted. (The tendency to scale-formation is thus reduced by

boiling-out dissolved gases and precipitating salts.) Then control heat at the minimum necessary to maintain boiling. This eliminates wastage of water by vaporization and so the necessity to add water to make up the volume. Instruments should be dried immediately on completion of sterilization and placed in covered aseptic containers.

Drain and clean sterilizer at the end of each day. Scale accumulation on electric sterilizers may hasten burning out of the elements.

D. Hot Oil Bath.

Sterilization of handpieces is probably the most inconvenient and least often considered operation in dental practice. The problem of lubrication and minimisation of wear precludes any treatment which does not utilize oil. Several solutions have been suggested for cleansing handpieces by standing or operating therein at room temperature for certain lengths of time. These cannot be considered from the point of view of sterilization.

Baths of oil heated to various temperatures have been used for some time and apparently some success has been achieved. Temperatures have to be high or times long for destruction of sporing organisms. However, as the handpieces do not become dried out, the problem of spores is assumed to be slight.

Light mineral oil at 148° to 154°C. for 5 to 10 minutes to 121° to 125°C. for 10 to 15 minutes is a practical and efficient means of disinfecting previously cleansed handpieces, where spores are not considered a hazard. A temperature of 160°C. would be necessary, if white mineral oil were to be considered equal to boiling water at 100°C., in destroying bacterial spores within 20 minutes.

Another method used two mixtures[1].

(i) AClO (surgical)—a mixture consisting of 95% light petroleum oil, 5% complex metallic petroleum sulphonates.

(ii) AClO soda solution—a mixture of 2gm. sodium carbonate-decahydrate, 2cc. AClO (surgical) made up to 100cc. with water.

Suggested technique: soak handpieces in (i), boil and allow to dry overnight. After each use boil in (ii): five minutes for vegetative cells, 30 minutes for certain destruction of spores.

Recently we have seen an apparatus which it is claimed sterilizes handpieces in the ordinary dental sterilizer. This consists of a cylinder with a clamp-fitting lid, not unlike a small dental vulcanizer. Inside is a perforated metal basket into which the handpieces are placed. The cylinder is ⅔ filled with oil, the lid clamped on, and then the cylinder is immersed in the boiling water of the surgery sterilizer. The temperature inside could not possibly reach more than 100°C. In the light of the above figures, will this be effective in sterilizing dental handpieces?

A small electrically heated bath containing paraffin or light mineral oil (Wakefield 8440) and capable of temperatures 145° to 150°C. is the best mechanism for the implementation of this technique. Stand the handpieces on end to drain when removed.

Other delicate (e.g., cutting) instruments may be sterilized by this process.

1. Harvey, W.—Brit.Dent.J., 86:126, 1949.

E. COLD CHEMICAL SOLUTIONS. (At room temperature, 20°C.).

The majority of authorities do not look upon cold chemical solutions as entirely effective for sterilization. However, chemical sterilization is very convenient in regard to: ease of application, freedom from exposure to heat (and loss of temper) or from corrosion and dulling of edges, and simplicity of equipment necessary. But electrolysis may occur with dissimilar metallic instruments in the same solution.

Chemicals act on bacteria by combination of the whole molecule with the organism, e.g., phenols, or by adsorption of their ions in solution. Surface tension plays an important part in the speed of action, and for this reason soaps or detergents are used in sterilizing solution to lower the surface tension. A cardinal rule is that all instruments *must* be scrubbed clean with soap and water before immersion, as many of the chemicals are inactivated by the presence of serum, blood or pus.

The solutions may be classified as caustics and non-caustics. Caustics, to be of any real value, have to be used in strengths which would destroy body tissues, and so great care is essential in handling the solution and washing instruments after immersion. Lysol is three times as batericidal and slightly less toxic than phenol. It is a soap solution of cresol. Common practice in the use of these caustics is as follows:—

i. Phenol. 10 minutes in 1:80 kills most common bacteria, although spores have greater resistance.

ii. Lysol. 10 to 15 minutes in 1:150 to 1:300 for common pathogens. Against tubercle organism cresol compounds are the choice.

Martindale gives "at least 1 minute for immersion in undilute lysol."

The non-caustics include mercurial compounds and non-mercurials. Simple mercury compounds are irritating, toxic, corrosive, inactivitated by soap and non-sporicidal. They act by combination of Hg with sulphydryl (SH) groups in cells. Complex mercurials such as metaphen and merthiolate have greater potency and less toxicity than simple mercurials. However, they are not as efficient as is commonly believed.

Non-mercurials include quaternary ammonium compounds, e.g., zephiran. These are cationic and surface tension depressant. 10 minutes' immersion in 1:50 aqueous solution should suffice (5 minutes' immersion in 1:500 destroyed *B. subtilis* spores) but in emergency 5 minutes in 1:10 aqueous solution or 2½ minutes in 1:30 alcoholic (absolute) solution will do.

For storage of sterile instruments the following may be used:

(i) zephiran—1:200 aqueous + 0.5% sodium nitrite (anti-corrosive).
(ii) dettol—1:4 spirit.
(iii) dettol—1:2 aqueous.

Tainter[2] and others have developed the following solution for sterilization. The ingredients are mixed in the order given.

Isopropyl alcohol	1000cc.
Oil of rose geranium	2cc.
Oil of cinnamon (or cassia)	4cc.

2. Tainter, M. D., *et al.*—J.A.D.A., 31:479, 1944.

Distilled water	780cc.
Sodium nitrite	4gm.
Monoethanolamine or triethanolamine	60cc.
Solution formaldehyde (8%) U.S.P.	160cc.

Total volume is 2010cc.

This solution has a less objectionable odour than formaldehyde; is non-corrosive to steel, copper, aluminium; is alkaline and has a low surface tension.

In it common pyogenic organisms, in vegetative form, are killed in 1 minute. Immersion of instruments for 10 to 15 minutes is sufficient to sterilize, but for spores 4 to 5 hours' immersion is necessary.

There is one disadvantage and that is that continued skin contact with this solution may produce a dermatitis.

E. Solution for Sterilizing Skin Surfaces.

In latter years some doubt has been felt as to whether the elaborate preparations of the skin surfaces previously used have been necessary. This idea has been strengthened by records of healing following emergency surgery with a minimum of skin preparation.

Shaving, if necessary, is the first procedure and then the scrubbing of the area with soap and hot water to endeavour to remove most of the casual organisms. The skin is then dried with a sterile swab and wiped over with ether. Some organisms naturally inhabit crevices in the skin and no method of preparation can guarantee their destruction. However, most wound infections are proved to be caused by extraneous organisms.

Little significance is placed on the application of antiseptics whether they be iodine (2½%), spirit, mercurials (biniodide, metaphen, merthiolate), flavine or dyes. The possibility of iodine idiosyncrasy should not be overlooked. However, alcoholic solutions of these drugs appear to be more effective than aqueous. Agents with greater wetting powers (e.g., zephiran) seem to have more rapid action than others with higher surface tension. Gardner[3] found that 2% iodine in 70% ethyl alcohol achieved "virtual disinfection" of flat unwashed clean skin in 30 seconds. The detergents, zephiran 30%, cetrimide 10%, both in 70% ethyl alcohol gave satisfactory disinfection in 30 to 45 seconds.

Ethyl ether, chloros and various mercurial preparations, have either slower or otherwise imperfect disinfecting power.

2. Preparation of Field of Operation.

Dr. Wallace:

My part of the subject under discussion has to do with the sterilization or, perhaps I should say, preparation of the field of operation, and it should be possible to cover this in comparatively few words.

Preparation of Intra-oral Surfaces.

It will be obvious that careful sterilization of instruments, swabs, dressings, etc., may be largely nullified if the operation is carried out in a septic field. The

3. Gardner, A. D.—Lancet, II:760, 1948.

mouth is a septic cavity but, in conditions of normal health, the organisms found there live in a happy state of symbiosis, both in relation to one another and to the tissues of the mouth. It is likely, too, that antibiosis is a prominent feature of mouth organisms in order to maintain the balance and prevent the development of any one type of organism to the exclusion of others and also to limit the exploitation of the field by pathogenic varieties.

Any attempt to sterilize the mouth as a whole is doomed to failure and may result in disturbing the balance that has been established, which in health constitutes no threat to the well-being of the tissues of the host. Vigorous rinsing or spraying of the mouth with saline solution has been shown to reduce temporarily the numbers of organisms present, without interference with the interrelation of the oral bacteria to one another or with the vitality of the surface epithelium. This procedure then might be considered a suitable preliminary to further preparation of the actual field of operation, and would be akin to a preliminary skin preparation by the use of soap and water.

It is taken for granted that surgical cleanliness of the teeth and gingival crevices has been secured by removal of deposits, the flushing of pockets, etc.

Final preparation of the field lies with the choice of the operator. If the field of operation is within the mouth, the surgeon is in a favourable position in the knowledge that he is dealing with an area in which a high local immunity to all the organisms that are normally present has already been established. On the other hand, he also knows that his carefully prepared area of mucous membrane cannot be maintained in a sterile condition, even if it were possible to render it so. At any moment a surge of saliva may flood the area, an uncontrolled movement of the tongue may displace the sterile protecting gauze swab or any one of a number of possible eventualities may render ineffective the best efforts to maintain complete asepsis. The surprising thing is that very rarely do such mishaps result in wound infection. Credit for this no doubt partly belongs to the local immunity already referred to, and partly to the very free blood supply of the oral tissues. While this happy state does not in any wise justify any remission of necessary precautions, it does point to the fact that real danger of wound infection does not lie so much in possible contamination from the usual inhabitants of the mouth as in the introduction of extraneous organisms from without by the surgeon in the course of the operation.

After the preliminary cleansing with a detergent spray, an area somewhat larger than that to be involved in the operation is dried with a sterile gauze swab and painted with some approved antiseptic solution. The choice of spray is limited because of the danger of tissue damage or destruction by the more powerful agents. Tincture of iodine in 2½% solution in 70% alcohol is the general choice, and it is claimed that organisms not actually destroyed are fixed to the epithelial surface. Tincture of metaphen is another commonly used agent and, while slower in action than tincture of iodine, it has the advantage of not producing sensitization. A certain proportion of people are allergic to iodine and some rather inconvenient and uncomfortable reactions may occur. Mercurochrome is favoured by some because of its non-irritating qualities but again its activity is somewhat slower than that of tincture of iodine. Alcohol in 70% dilution is also serviceable, and doubtless many other "plain and fancy" preparations will rise to the mind as this discussion proceeds. The fact of the

matter is that, whether plain or fancy preparations or no preparation at all are used, the end-results are pretty much the same, provided foreign organisms are excluded by all ordinary surgical precautions.

Preparation of Extra-oral Surfaces.

The cleansing and preparation of skin-surfaces for extra-oral operation call for a little more detailed care than mucous surfaces do, though the general principle is the same. The use of strong antiseptics and heavy mechanical irritants is to be avoided, as this leaves the area more susceptible to infection. Although all kinds of bacteria accumulate on the skin-surfaces, these are easily removed by repeated washing with hot water and soap. The difficulty lies with the intradermal bacteria, i.e., those which are well entrenched in the ducts of the sweat and sebaceous glands and in the hair follicles. After removal of hair by shaving, several applications of hot water and soap will bring many of these to the surface by increasing the secretion from the glands. More reliance is to be placed upon this mechanical cleansing than upon the use of chemicals. Finally the area is dried thoroughly and painted with tincture of iodine, commencing at the centre of the field and moving radially outwards. Unless the operation is to be proceeded with immediately, the whole area should then be covered with a sterile gauze pad.

3. Techniques to be Employed in the Practice of Operative Dentistry.

Mr. Lyell:

For my part in this discussion I will briefly cover some of the sterilizing procedures which are peculiar to Operative Dentistry.

The Sterilization of Dentine.

In cavity-sterilization procedures there is confusion and a lack of scientific proof. Many claim that there is a need for routine sterilization of all cavities after preparation for filling.

There is some doubt whether bacteria are present in the dentine after the cavity has been prepared. Some investigators[4] have found that the superficial layers of carious dentine are always infected, that intermediate layers are sometimes infected, but that partially decalcified dentine, adjacent to sound dentine, and sound dentine are always sterile.

It is claimed that the decalcification of the dentine may precede the carious process and that, when the decalcification of the dentine has reached the pulp, the invading bacteria may be still some distance away. In this case it would seem logical to leave the sterile decalcified dentine in place rather than remove it and so run the risk of injuring and infecting the pulp. If we are sure that no contamination of this "sterile" decalcified dentine has taken place during operative procedures, the application of a disinfectant should not be absolutely necessary. However, in such cases it is advisable to apply a germicide to destroy any possible surface bacterial contamination.

Other investigators[5] have asserted that bacterial invasion precedes decalcification. If this is the case or if it is necessary to leave carious dentine in a

4. Dorfman, A., Stephan, R. M. and Muntz, J.—J.A.D.A., 30:1901, 1943.
5. Seltzer, S.—J.A.D.A., 39:148, 1949.

cavity, routine cavity sterilization becomes a very important procedure in cavity preparation.

Few of the commonly used germicides can be relied upon to penetrate and sterilize appreciable amounts of carious dentine[6], even though the concentration of the germicide and the length of time of application are at the maximum practicable. When a carious floor of dentine is left in a cavity in order to prevent exposure of the pulp, a germicide must be employed that can be relied upon to give more than surface sterilization.

Stephan, Muntz and Dorfman[7], in their study of the effective penetration of germicides into carious lesions, attempted to determine how great a thickness of infected dentine could be sterilized by an application of silver nitrate for a time that is feasible in routine dental practice. They also tried to establish whether some of the other commonly used germicides could be effective for this purposes. Their results make it evident that sterilization of infected dentine in carious lesions is possible with a saturated solution of silver nitrate but only if the tested procedure is followed. They claim the time of application is all-important. It was found[7] that a one-minute application of a saturated solution of silver nitrate sterilized carious dentine to an average depth of 0.3 mm, and a ten-minute application to a depth of 1.3 mm. Ammoniacal silver nitrate (Howe's solution) was slightly less effective.

However, Zander and Burrill[8], using Howe's sólution, conclude from their experiments that the length of time-of-application of the silver nitrate solution before its precipitation does not appreciably influence its depth of penetration but that this depth of penetration increases as time goes on after the precipitation.

Most investigators have found that 95% phenol is of practically no value as a germicide if any appreciable thickness of dentine must be sterilized.

Thymol in pure liquid form or as a saturated solution in alcohol has been suggested for cavity sterilization. Conclusive proof of its effectiveness has still to be advanced.

Penicillin—although reports have been made of succesful use of penicillin in root canal therapy there are no records of its use for cavity sterilization.

I think that our conclusions about the treatments now in use have advanced little from those of Miller[9] in 1891 who wrote "the thorough sterilization of decayed dentine requires more time and care than we are accustomed to bestow upon it."

The Sterilization of Root Canals.

The sterilization of infected root canals has been the subject of more investigation than has been the case with the sterilization of cavities. The drugs that have been used are many; their suitability for this purpose is determined by an ability to penetrate into the dentinal tubules and fine root canals and effect rapid sterilization with as little damage as possible to vital tissues or the tooth.

---

6. Muntz, J. A., Dorfman, A. and Stephan, R. M.—J.A.D.A., 30:1893, 1943.
7. Stephan, R. M., Muntz, J. A., and Dorfman, A.—J.A.D.A., 30:1905, 1943.
8. Zander, H. A. and Burrill, D. Y.—J.Dent.Res., 22:89, 1943.
9. Miller, W. D.—Dent.Cosmos, 33:342, 1891.

The drugs used are allowed to remain in the root canal in contact with the dentine surface to be sterilized for a period of about 48 hours. Most of the medicaments are replaced after 48-hour intervals at least five or six times before the root canal reaches a stage when it may be filled. The readiness of the canal for filling is indicated by the fact that a culture from it produces no growth in 48 hours. Such a culture does not necessarily show that the canal is sterile but is our best means of testing its condition.

The drugs in common use are some of the phenolic compounds (e.g., creosote), chlorine preparations and amino-acridines. More recently penicillin and streptomycin have been combined in an attempt to produce more quickly the condition required before filling. A suspension of penicillin and streptomycin has been suggested of 500,000 units of each antibiotic per cubic centimetre of sterile peanut oil. With this suspension it was found[10] that the canal was ready for filling after two dressings. It should be realized, however, that any so-called sterility of the root canal is largely confined to the surface of the root canal. Unless hermetic sealing of the canal quickly follows its preparation, re-infection may take place from the parts of the dentinal tubules or accessory canals which may not have been reached by the medicaments used.

The general procedures for sterilization of instruments, etc., in operative dentistry are exactly those which have been described by Mr. Corbett.

Instruments are boiled or autoclaved; handpieces and cutting instruments are sterilized in oil. All dressings are autoclaved and, as far as possible, the teeth which are operated upon are separated from the remainder of the mouth by a rubber dam. Teeth enclosed in a rubber dam can be kept free from contamination from the mouth during operative procedures so the use of such a dam assists in maintaining sterility in the field of operation. The sterilization of the area enclosed by the rubber dam is carried out with a non-staining antiseptic, such as has been already described.

10. Grossman, L. I., and Stewart, G.—Oral Surg., Oral Med., Oral Path., 2:374, 1949.

YEAST-LIKE ORGANISMS IN THE MOUTH

B. LILIENTHAL.†

Introduction.

The "yeasts"* found in the mouth are a complex group consisting of the following:—

(a) Ascosporogenous yeasts which are characterised by the formation of sexual elements called ascospores. The union of genetically different ascospores can lead to variation in the physiological properties of the strains. In addition to reproduction by means of ascospores, they can also multiply by the simple vegetative method of budding.

(b) Members of the genus Candida, of which the *thrush* fungus (Candida albicans) is the most important species. It is also the "yeast" most frequently found in the mouth. Species in this genus are characterised by oval budding cells which produce a mycelium in a suitable environment.

(c) Members of the genus Cryptococcus which are incapable of either ascospore- or mycelium-production.

The "yeasts" are usually found in the mouth as oval budding cells but elongated forms may occasionally be seen. Colonies in cultures prepared from saliva are composed very largely of oval budding cells.

Pathogenicity.

Candida albicans, the commonest "yeast" in the mouth and the only pathogenic species in the group, causes *thrush* usually in infants and persons suffering from debilitating diseases such as diabetes mellitus. Ludlam and Henderson[1] showed that the appearance of C. albicans in the mouth of an infant was invariably followed by some signs of thrush if the disease was not already clinically obvious. The occurrence of the fungus in the mouths of older children and adults free from thrush suggests that some change may have occurred either in the pathogenicity of the organism or in the immunity of the host. Lilienthal[2] showed that over 30% of young adults harboured the thrush fungus in their mouths.

Infection of *root canals* of teeth by C. albicans is known to occur, although the frequency of such infection is not known. Treatment of root canals infected by this organism (as well as others) may be difficult, particularly if sulphonamides, penicillin[3] or streptomycin are used, owing to the high resistance of the organism to these compounds.

Occasionally claims are made that "yeasts" have an important role in the aetiology of *dental caries*. However, the evidence for these claims is not convincing. Evidence for the existence, *in vitro*, of symbiotic relationships

---

†Dental Research Scholar, University of Sydney.

*The term "yeasts" is used in this paper in an inclusive sense to indicate all yeast-like organisms.

1. Ludlam, G. B., and Henderson, J. L.—The Lancet, 242:64, 1942.
2. Lilienthal, B.—Aust.J.Exp.Biol.Med.Sci., 28:279, 1950.
3. Bartels, H. A., and Buchbinder, M.—J.Dent.Res., 24:315, 1945.

between oral bacteria was advanced by Fosdick[4], Hansen[5] and Wessinger and Fosdick[6]. Their results indicated that "yeasts" could initiate acid-production more rapidly than lactobacilli and that the latter organisms could conclude the process more quickly than the "yeasts"; the two types of organisms together could produce acid more quickly than either alone. Mixtures of other bacteria could also produce large quantities of acid. Recently Lilienthal[7] studied lactic acid-production by pure and mixed cultures of lactobacilli and C. albicans. The results of these experiments suggested that stimulation of lactic acid-formation by lactobacilli did occur in the presence of C. albicans. This effect was thought to be due to a diffusible heat-stable substance such as a vitamin but not to an enzyme.

Occasionally infection occurs at sites other than those already mentioned, e.g., the respiratory and female genital tracts.

Microbiology.

The first clear description of the *thrush fungus* was given nearly a century ago and until quite recently no extensive study of the fungus and the other "yeasts" in the mouth was attempted. Unreliable and inadequate methods and the lack of a satisfactory classification were largely responsible for this situation. However, Benham[8] and Martin et alii[9] devised both reliable methods of study and a workable classification of the genus Candida. Using these techniques Knighton[10] classified the "yeasts" isolated from the mouth and found that the thrush fungus (C. albicans) was the commonest species. This observation was verified in the more extensive studies of Lilienthal and Goldsworthy[11a, 11b]. Table 1 shows the classification of 166 strains of "yeasts" isolated from the mouth.

TABLE 1.

Classification of 166 strains of "yeasts" isolated from the mouth.

Species.	No. strains.	% strains.
Candida albicans	118	71.1
„ krusei	8	4.8
„ parakrusei	2	1.2
„ * tropicalis	1	0.6
Yeast	27	16.3
? Candida albicans	5	3.0
? „ tropicalis	2	1.2
? „ stellatoidea	1	0.6
Unidentified	2	1.2
Total	166	100.0

*All strains in this group failed to produce mycellium. Some strains produced ascospores (10 strains = yeast), the others did not and thus are probably cryptococci.

4. Fosdick, L. S.—Northwest.Univ.Bull., 37:23, 1937.
5. Hansen, H. L.—Northwest.Univ.Bull., 37:21, 1937.
6. Wessinger, C. D., and Fosdick, L. S.—Northwest.Univ.Bull., 37:27, 1937.
7. Lilienthal, B.—Aust.J.Exp.Biol.Med.Sci., 28:287, 1950.
8. Benham, Rhoda W.—J.Inf.Dis., 49:183, 1931.
9. Martin, D. S., Jones, C. P., Yao, K. F., and Lee, L. E.—J.Bact., 34:99, 1937.
10. Knighton, H. T.—J.Dent.Res., 18:103, 1939.
11a. Lilienthal, B., and Goldsworthy, N. E.—Aust.J.Exp.Biol.Med.Sci., 28:261, 1950.
11b. Lilienthal, B., and Goldsworthy, N. E.—Aust.J.Exp.Biol.Med.Sci., 28:271, 1950.

SUMMARY.

Following advances in the techniques for studying "yeasts", particularly Candida, a few workers have investigated the possible role played by these organisms in oral disease. Candida albicans has been shown to be the important pathogen in the group as well as the most frequently occurring species.

In the mouths of infants the mucosa appears to be particularly susceptible to thrush. This susceptibility may be due to lack of a complex inhibitory flora such as is usually found in the adult mouth. Although the fungus may be present in up to 30% of adults, it is not responsible for lesions of the soft tissues in the mouth, except in a few specific instances.

The role of "yeasts" in dental caries is still not understood. C. albicans may play a secondary role and its participation in symbiotic systems may be of great importance. Further studies of these systems are required before adequate knowledge can be obtained of the role of bacteria in dental caries.

Excluding vaginal thrush, which is a common condition, infections with Candida in other extra-oral sites are rare.

DENTAL MATERIALS

Current Notes (No. 5).*

Better Wax Elimination and Smoother Surfaces.

If a plaster or investment mix is brought into contact with a wax surface, bubbles are liable to form making it difficult to obtain completely smooth unpitted surfaces. This phenomenon may be observed by pouring water onto a sheet of wax—globules will form because of the interfacial tension between the materials.

It is possible, however, to make the water flow in a thin film over the wax by using what are termed surface-active or wetting agents. Thus, when a waxed-up denture or wax inlay pattern painted with a suitable wetting agent is invested, the plaster or investment mix will flow smoothly over the wax facilitating the elimination of air bubbles and giving a superior surface finish to the final product.

Agan, after removing the softened wax from a denture mould, it is necessary to boil out the remaining traces of wax. When this is done, small globules of molten wax are often observed adhering to the mould and these are very difficult to dislodge. However, if a suitable wetting agent is used in the boiling-out water, globules will not form and the wax will be eliminated with greater ease and certainty.

In the case of repairs where a kettle is used, the wetting agent is added to the water.

There is a multitude of wetting agents, but relatively few are readily available in Australia. The oldest and commonest, of course, is plain soap but its alkalinity and tendency to foam in hot water detract from its usefulness for dental applications. One wetting agent recommended in dental literature is the product Aerosol OT available in limited supplies through the Australian representatives, Hardie Trading Ltd. Solutions equivalent to only 0.1 per cent. need be used; as this concentration is only one part in 1000 a small quantity should last for a considerable time.

In addition there are several commercial solutions conveniently made up for painting wax patterns. Examples of these are Cerasol (Amalgamated Dental Co. Ltd.) and Investo Debub-l-izer (Investo Manufacturing Co. Pty. Ltd.).

Other surface-active agents are obtainable from the various oil companies and chemical manufacturers and suppliers. They should be used in the dilutions as recommended; if no directions are supplied try very dilute solutions of not more than say 0.5 per cent. for painting wax surfaces. For wax elimination add some of the solution to the hot water.

*Contribution from the Commonwealth Bureau of Dental Standards.

The DENTAL JOURNAL of AUSTRALIA
N.S.W.

EDITORIAL DEPARTMENT

SERVICE TO THE PUBLIC

Once a man accepts a profession as his calling, no matter in what sphere, it is automatically assumed that he is prepared not only to practise that profession to the best of his ability but also to practise it for the good of his fellow citizens. This is even more applicable when we consider the ideals of the healing professions.

The profession of dentistry is gradually emerging from its swaddling clothes and is a lusty infant proclaiming loudly its ability to stand on its own two feet. It would be a great pity, however, should this infant ever fail to appreciate the lessons which its older relative—the profession of medicine—can teach it.

Throughout the centuries the profession of medicine has gradually won a small niche amongst the immortals by the unselfish practice of the profession in order to benefit mankind, without thought of immediate recompense. Today such practice has developed into a very organised system of honorary work carried out mainly at public hospitals.

So far the dental profession has been unable to join in, to any degree, such service to the public; but the need undoubtedly exists and there is a feeling amongst many of the profession that such action would greatly assist in the furtherance both of the standards and ideals of the profession.

It is an extremely difficult thing for bedridden patients, particularly those in hospital, to obtain adequate dental service. At the moment honorary dental work in hospitals is not greatly organised nor does it play any prominent part.

One of the first problems to be faced is that one honorary dental surgeon in a hospital can accomplish little. It may be wise, therefore, to consider the advisability of establishing dental clinics within the organisation of hospitals so that young full-time dental graduates might not only gain excellent experience in the practice of dentistry but also learn something of the general practice of medicine and have the benefit of working under honorary dental surgeons of high calibre.

This development would forge a greater link between the medical and dental professions at the same time as supplying a great need throughout the cities and country for the treatment of people who otherwise would be denied it. Thus, one could imagine the gradual establishment of an honorary system, of which the profession could be justly proud and whereby a service would be provided for the public which at the moment is lacking. With it could grow a form of service to the public (through the dental clinics within the hospitals) which would be of inestimable value, particularly in maternity and children's hospitals and in country centres where so often adequate dental care is unfortunately not available.

There need be no fear that this would mean subservience to the medical profession. The senior honorary dental surgeon need be no less a personage than the senior physician or surgeon. It would mean only a re-vitalizing of our ideals and a re-forging of our link with the medical profession.

News and Notes

COUNTRY DIVISIONS FIRST CONVENTION

ARMIDALE, 20-24TH AUGUST, 1951.

Preparations for this Convention are well in hand. The Organising Committee consists of R. Krauss (President), J. Benson (Secretary), and W. Harvey, A. R. J. Wooller, L. McConvill, W. H. McBean and *ex officio* the Chairmen of the Country Divisions of New South Wales. This Committee is very enthusiastic about all arrangements and will do everything it can to ensure success.

The Convention will be held at the New England University College—there isn't a more suitable place outside Sydney—lecture theatres, demonstration rooms, common rooms, full accommodation with beautiful spacious grounds and tennis courts.

Visiting lecturers and clinicians include many eminent authorities in their particular fields. There will be lectures, clinics, table demonstrations, films, sports, etc., all arranged so that any member of the Convention will be able to attend practically every session if he wishes. Many sessions will be repeated.

The Convention Committee extend to you a sincere invitation to come to Armidale in August.

Application forms will be available shortly and may be obtained from Dr. J. D. Benson, Secretary, P.O. Box 163, Armidale.

WESTERN SUBURBS DENTAL GROUP

The Western Suburbs Dental Group held their first post-war Dinner at "Amory," Ashfield, on Tuesday, 13th March. There were over 80 present, including representatives from the Australian Dental Association, New South Wales Branch, the Dental Board of New South Wales, the Blue Mountains Division, the St. George Dental Association and the Eastern and Northern Suburbs Groups.

During the evening the President, Mr. R. G. Leeder, supported by Dr. J. S. Baird, paid tribute to Dr. Roy Cloutier. On behalf of the members of the Group he then presented Dr. Cloutier with a cigarette-lighter and wallet, as a mark of esteem and appreciation.

On Thursday, 24th May, the Western Suburbs Dental Group will be holding their Annual Golf, Bowls and Tennis Day at Concord Golf Club.

As the function has proved so popular in previous years the Western Suburbs Dental Group will again be holding their Annual Ball at Petersham Town Hall. The date is Tuesday, 12th June, 1951.

SPARE COPIES OF JOURNALS

A request has been received from Professor Robert Harris, for copies of the *Dental Journal of Australia*, to complete his files in New Zealand. The following issues are required:

Vol. 19, No. 2 (February, 1947).
Vol. 19, No. 4 (April, 1947).

Should any member be able to supply these copies, the Editor would appreciate their being sent to the Office of the Australian Dental Association, for despatch to Professor Harris.

PRACTICE FOR SALE

A well-established dental practice is for sale in a leading town in Tasmania, as the owner is retiring and leaving Australia. For further particulars ring FB 2698 before 10 a.m. or after 6 p.m.

SPORTS DAYS DURING 1951

24th May—Western Suburbs Dental Group (Golf, Bowls and Tennis), Concord Golf Club.

21st June—Northern Suburbs Dental Group (Golf and Bowls), Killara Golf Club.

2nd August—Australian Dental Association (New South Wales Branch), Golf and Bowls, Lakes Golf Club.

18th September—St. George Dental Association (Golf and Bowls), Roselands Golf Club.

28th September—Blue Mountains Division (Golf and Bowls), Leura Golf Club for Golf and Katoomba Bowling Club for Bowls.

18th October—"Flavelle Cup" (Golf and Bowls), Concord Golf Club.

2nd week December—"Jennings Shield" Graduates vs. Undergraduates Cricket Match. Date and place to be notified.

ANNUAL CRICKET MATCH

DOCTORS vs. DENTISTS.

This match was played at the Sydney Cricket Ground on Wednesday, 7th March, 1951, but after a most exciting and eventful day's play the match ended in a draw.

The final scores were:

Dentists—Innings closed at 9 for 190.

Doctors—8 for 78.

The shield is retained by the dentists.

Association Activities

AUSTRALIAN DENTAL ASSOCIATION FEDERAL NEWSLETTER No. 2

On account of the regretted resignation of Mr. Robert Harris from the office of Honorary Secretary, it was decided to hold a meeting of the Federal Executive before the normal quarterly interval would elapse. As the Minutes indicate, the meeting was held on Saturday, 9th December, 1950, in Sydney.

1. Repatriation Dental Treatment.

As all the State Branches had not had time to furnish a report to the Federal Executive, this subject was deferred.

2. Membership of the Federation Dentaire Internationale.

As yet, no reply has been received from London to our correspondence in regard to membership.

3. Pharmaceutical Benefits Act.

The reply of the Minister for Health to our application for the extension of benefits to dental patients stated that at this juncture the Government is unable to consider any amendment to the Act.

In view of the serious necessity for such an amendment, the President proposes to take an early opportunity to discuss the subject personally with the Minister.

4. Honours and Awards.

The Association's Solicitors have replied to our letter seeking advice as to the constitutional position arising from the discussion and resolution passed at the Annual Meeting.

Their opinion stated, *inter alia*, that, as the agenda circulated to State Branches prior to the meeting did not include any reference to this subject in terms required by Section 8 (f) (3) of the Constitution, the consequent action in this matter was unconstitutional.

The Federal Officers decided that, in view of this difficulty, nothing further be done until the position is clarified at the next meeting of the Federal Delegates.

5. Alien dentists.

A conference was held between officers of the Department of Immigration, and Labour and National Service, and the President and Honorary Secretary of the Federal body on Tuesday, 28th November, 1950, in respect of alien dentists.

Various aspects of the Dental Acts were discussed and, after discussion, it was obvious that the Departmental representatives were unaware that the respective State Dental Boards gave such careful consideration to the applications of alien dentists, and it would seem that this information may well reassure the Government that adequate facilities are available.

6. National Health and Medical Research Council.

A report was submitted by the President regarding the proceedings of the thirtieth meeting of the Council, which he attended on 22nd November, 1950, which dealt with dental caries and its prevention. It was pointed out by the President that no statistics of the present incidence of dental caries in children had been scientifically collected and collated for some years and, therefore, in view of possible future Federal Government policy to provide treatment for children, such information was extremely important.

The Council appreciated the significance of this project, both for the purpose of determining the lowered incidence of caries in fluoride areas and for the determination of the incidence in control groups.

After careful consideration, it was resolved to ask the Director of the Institute of Dental Research, Dr. Goldsworthy, to submit the cost of such a project carried out on a limited scale.

The restriction of funds available to the Council necessitates a survey on limited lines, but success in the initial stages, if the proposal is approved, may well lead to the expectation of further development in this field of investigation.

The following grants were renewed for dental research:—

Institute of Dental Research, Sydney: application by Dr. N. E. Goldsworthy, the Director, for continuance of investigation of various aspects of dental caries—£2,687.

Western Australian College of Dental Science, Perth: application by Professor H. G. Radden for continued research on peripheral nerves of the oral cavity and innervation of tooth buds in the human embryo—£556.

7. XIIth Australian Dental Congress.

The Federal Executive accepted the surplus arising from the 12th Australian Dental Congress as forwarded by the Congress Commission, subject to any further accounts being received. The amount received was £109 9s. 9d. and, after approving payment for an unexpected account for £32 8s. 4d. from the Town Hall for demolition of partitions, the balance stands at £77 1s. 5d., to be placed to the credit of the Congress Trust Fund Account.

8. Tokens to Immediate Past Federal Officers.

A letter was received from the President of the Victorian Branch suggesting that some form of recognition be accorded the retired officers, and enclosing a cheque for three guineas. The Federal Officers resolved to express their appreciation to the Victorian Branch, and to forward this information to other State Branches and invite them to participate in such a well-deserved recognition.

9. Standards Committee Grant.

Following a request from the Standards Committee, it was agreed to send a grant of £10 to enable the Committee to continue its excellent work.

10. Resignation of the Honorary Secretary and Treasurer, and appointments.

The Federal Executive accepted with great regret the resignation of Mr. Robert Harris, who has given such outstanding service to the profession in many capacities, on his appointment as Professor of Conservative Dentistry at the University of Otago, New Zealand.

Mr. N. E. Edney submitted his resignation at Honorary Treasurer, which was accepted, and he was duly appointed Honorary Secretary in terms of Section 6 (e) of the Constitution

Subject to his approval and acceptance, the Executive resolved to appoint Mr. H. McD. Finnie to the vacant position of Honorary Treasurer under the same constitutional provision.

With every good wish for a successful year in your State Branch activities,

Yours faithfully,
J. V. HALL BEST,
President.

NEW SOUTH WALES BRANCH EXECUTIVE MEETINGS

Extract from the Minutes of the Meeting of the Executive Committee held in the Council Room, B.M.A. House, 135-137 Macquarie Street, Sydney, on Monday, 12th February, 1951, at 7.30 p.m.

Present: Dr. E. R. Magnus, President, in the Chair; Dr. A. G. H. Lawes, Vice-President; Dr. F. E. Helmore, Vice-President; Mr. F. R. Reid, Honorary Treasurer; Mr. N. E. Edney, Dr. E. H. Bastian, Mr. H. M. Finnie, Mr. W. A. Grainger, Mr. R. Krauss, Mr. R. G. Leeder, Mr. R. W. Wilson, Mr. A. G. Hunter, Mr. E. J. Gee; Dr. J. D. Oddy, South Coast Division; Dr. A. G. Rowell, Western Division; Mr. C. D. Reynolds, Newcastle & Hunter River District Division; Mr. A. R. Wooller, North & North West Division.

Apologies: Mr. R. Y. Norton, Mr. H. R. Sullivan, Mr. Ralph Tompson; Mr. M. J. Griffin, Blue Mountains Division.

In attendance: Mr. E. F. Hewlett, Secretary.

Minutes: The Minutes of the Ordinary Meeting held on 11th December, 1950, were signed as a correct record.

Business Arising from Minutes:

Closure of Financial Year: A letter was received from the Association's Auditors advising that they concurred with the changing of the closing date of the Association's year to the 31st August.

Basic Wage increases: The Secretary reported that all members had been advised of the latest basic wage increase which would take effect on the first full pay period in February.

Membership: The action of the Honorary Officers at their meeting on 24th January, in admitting the following members, accepting the following resignations and accepting the following Fourth Year students as Student Associates, was endorsed.

New members: Kurt, Miss Ilse Mary, B.D.S.; Miller, Alastair, B.D.S.: Mussett, Francis Wilfred, B.D.S.; Rosanes, Heinrich, B.D.S.; Schwartz, Bela, L.D.S., R.C.S., H.D.D.; Walker, Vincent Anthony, B.D.S.; Wallace, John Cecil, B.D.S.

Resignations: Campbell, Alan D.; Doudney, A. A.; Dumbrell, C.A.; Fraser, R. R.; Harcourt Andrews, W.; Jeffreys, John F.; Reuben, H. R.; Reaney, Phillip Bickley; Smith, A. G.; Wilson, A. A.; Wood, Dr. N. S.

Student Associates: Bellamy, John G.; Scahill, Thomas Anthony; Duckmanton, Norton Archie; Rowlands, William Trevor.

Deceased: It was noted with regret that Mr. H. A. Arnold, of Newcastle Street, Rose Bay, had died on 26th September, 1950.

Honorary Membership for Mr. A. A. Wilson: The Executive decided to recommend to the next General Meeting that Mr. A. A. Wilson be made an Honorary Member of the Association.

Business of the Meeting:

Research Scholar's Salary: The Association's contribution of £150 towards the first half-yearly instalment of the Research Scholar's salary was approved.

Conciliation Committees: Mr. E. F. Hewlett was nominated as the representative of the Australian Dental Association, New South Wales Branch, on the Dental Mechanics (State) Conciliation Committee, Dental Assistants & Secretaries (State) Conciliation Committee, and the Dental Mechanics (State) Apprenticeship Council.

Finance—Budget, 1951: The President presented the Budget for the twelve months ending September, 1951, and stated that the Honorary Officers, Secretary and Assistant Secretary had spent much time in the preparation of the Budget.

The Budget was discussed and, subject to some minor amendments, was received.

Financial Statement: The Honorary Treasurer, Mr. F. R. Reid, tabled the financial statements for the months of December and January and which had been circulated to members of the Committee, and these financial statements were received.

Federal Office:

Pharmaceutical Benefits Act: A letter from the Federal body, dated 19th December, 1950, was read, outlining their actions in regard to dentists prescribing free medicine and it was decided that this State Branch strongly urge the Federal body to make further and, if considered expedient, personal representation to the Minister to have the Act amended.

Reports from Committees:

Dental Health Education Committee: A report from the Dental Health Education Committee was received, stating that the Committee was reviewing its projects for this year and that the Dental Health Exhibit had been repaired and boxed.

Journal Committee: The Executive approved the action of the Journal Committee in increasing the advertising rates to attempt to offset the increasing costs of publication.

Membership Committee: It was reported that the Membership Committee had reviewed the matter of members' subscriptions and the Executive adopted the recommendations of this Committee.

Syllabus Committee: The Syllabus Committee reported that arrangements were well in hand for lectures at the General Meetings during the year and to date the following firm arrangements had been made:

March—Lecture on Self-Curing Resins, by Dr. McMullin.
April—"The Problem of the Mandibular Denture," by Professor Tuckfield.
May—Discussion on the Norsk Orthodontic Appliances, following a paper to be given by Dr. Lawes.
June—Paper on Oral Surgery, by Professor Arnott.
July—Lecture by Dr. Rowell.

The Executive approved these arrangements.

Sports and Social Committee: The Sports and Social Committee reported that it had prepared a sporting fixture list for the information of members, and that this list would be given publicity.

Upon the recommendation of the Sports and Social Committee, the Executive decided to elect Mr. L. Noone as an additional member of this Committee.

Membership:

The Executive admitted the following dental practitioners to membership of the Association:

New members: Bell, David Livingstone, B.D.S.; Fisher, Norman Stansfield, B.D.S.; Hogarth, Donald Lloyd, B.D.S.; Udall, George Gordon, B.D.S.; Wiggins, Harold John, B.D.S.; Burns, Rex Francis, B.D.S.; Charlton, Garry, B.D.S.; Cotterell, Francis Henry, B.D.S.; Gillings, Kevin John Raoul, B.D.S.; Goldsmith, Walter Jacob, D.M.D., B.D.S.; Logan, Walter Leslie, B.D.S.; McMahon, Sydney Brian, B.D.S.; Murphy, William Wallace, B.D.S.; Pillans, Robert John, B.D.S.; Savage, Miss Anne Philippa, B.D.S.; Wells, Donald Frederick, B.D.S.; Wolmers, Herbert Joseph, B.D.S.; Lambert, John Peter, B.D.S.

Resignation: The Executive received the resignation of Mr. R. B. Parker, of Epping.

Student Associates: The Executive accepted, as Student Associates, the following Fourth Year students:

Colligan, Leslie Arthur; Briffa, Arthur.

Deceased: It was noted with regret that Mr. H. W. Hoban and Mr. B. E. Solling had died recently.

Correspondence:

Resignation—Mr. H. R. Sullivan: The Secretary read a letter from Mr. H. R. Sullivan stating that, as he had been awarded a Nuffield Dominion Travelling Fellowship, he would be leaving for England in a few months' time and, therefore, regretfully tendered his resignation from the Executive Committee.

The Meeting expressed its pleasure concerning the academic honour which had been conferred on Mr. Sullivan in his research work, and it was decided that his resignation be accepted with regret, as a member of the Executive Committee, and that a letter of congratulation be sent to him, wishing him every success.

Staff:

Resignation of Assistant Secretary: A letter was read from Mrs. A. S. MacLean, tendering her resignation as from Friday, 9th March, 1951, and it was decided that steps be taken to secure a replacement for Mrs. MacLean.

General Business:

Vacancy on Executive Committee: It was decided that Mr. J. G. Fletcher be appointed to the Executive Committee to replace Mr. H. R. Sullivan and that he be so notified.

Lectures for Divisional Meetings: Approval was granted for Dr. Magnus and Dr. Rowell to lecture at Grafton on 24th and 25th February, for Dr. Helmore to lecture at Penrith on 10th March, for Dr. Magnus to lecture at Goulburn on 10th March, and for Mr. Grainger to lecture at Newcastle on 15th and 16th March, 1951.

Application from members for assistance in the delivery of new motor-cars: The Secretary reported that he had received several requests from members that the Association assist in procuring delivery of motor vehicles. It was decided that members who had approached the Secretary in regard to this matter be informed that, if the dealer telephoned the Secretary, he would supply all information.

Closure of Meeting: The meeting terminated at 11.55 p.m.

Extract from the Minutes of the Meeting of the Executive Committee held in the Council Room, B.M.A. House, 135-137 Macquarie Street, Sydney, on Monday, 12th March, 1951, at 7.30 p.m.

Present: Dr. E. R. Magnus, President, in the Chair; Dr. A. G. H. Lawes, Vice-President; Dr. F. E. Helmore, Vice-President; Mr. F. R. Reid, Honorary Treasurer; Mr. N. E. Edney, Dr. E. H. Bastian, Mr. H. M. Finnie, Mr. W. A. Grainger, Mr. R. G. Leeder, Mr. R. Y. Norton, Mr. Ralph Tompson, Mr. R. W. Wilson, Mr. A. G. Hunter, Mr. E. J. Gee, Mr. J. G. Fletcher; Dr. J. D. Oddy, South Coast Division; Dr. A. G. Rowell, Western Division; Mr. M. J. Griffin, Blue Mountains Division.

Apologies: Mr. R. Krauss, Mr. C. D. Reynolds, Newcastle & Hunter River District Division.

In attendance: Mr. E. F. Hewlett, Secretary.

Minutes: The Minutes of the Meeting held on 12th February, 1951, were signed as a correct record.

Business Arising from Minutes:

Annie Praed Oration: The President stated that this matter had been omitted last year, due to Congress; it seemed that the first Oration should deal with the life of Annie Praed and the part she played during her long career in the dental profession, together with a history of the progress of the profession during the years of her association with it.

It was resolved that Professor Arnott be asked to give this Oration, that the Great Hall, Sydney University, be the venue of the Oration, and that a committee consisting of Mr. Finnie, Dr. Lawes and Dr. Helmore, be appointed to arrange the details of the matter.

Appointment of Assistant Secretary: It was noted that Miss H. E. Harrington had been appointed Assistant Secretary as from Monday, 5th March, 1951.

Acceptance of appointment—Mr. J. G. Fletcher: Mr. Fletcher's letter accepting his appointment as a member of the Executive was read and it was resolved that this appointment be ratified.

Association's assistance re delivery of new motor-cars: Following a report from the Secretary that some motor-car distributors had requested letters in this regard, it was resolved that the previous Minute as of 12th February, 1951, be adhered to as the accepted procedure.

Business of the Meeting:

Federal Office: A letter from the Federal Office enclosing a copy of the Minutes of the Federal Executive meeting on 9th December, 1950, together with copies of Newsletter No. 2, was read and received.

Reports from Committees:

Honorary Officers: A report from the Honorary Officers concerning the proposed arrangement in regard to Dental Health Education activities was adopted.

Membership: The Chairman indicated that the forms of membership were under review by the Honorary Officers and recommendations would be made in the near future.

Change of Articles: A small committee was formed, as recommended by the Honorary Officers, to review the Articles of Association, consisting of Mr. Fletcher, Dr. Rowell, Mr. Norton and Mr. Gee.

Post-Graduate: The Chairman, Mr. Grainger, reported on the Post-Graduate Committee's co-operation with the Post-Graduate Committee of Dental Science of the University of Sydney and indicated that the matter of post-graduate courses by the Association itself would be dealt with at the next meeting of this Committee.

Illegal Practice: It was indicated that this Committee had met and would meet again in the near future to consider the matter of illegal practice.

Membership:

The following dental practitioners were admitted as members of this Association as from 12th March, 1951:

New members: Boshier, Thomas Henry, B.D.S.; Bradford, Murray Reginald, B.D.S.; Byrne, Noel Hamlyn, B.D.S.; Digges, Bryan Dudley, B.D.S.; Dobinson, Ronald Joseph, B.D.S.; Dyball, Robert John, B.D.S.; Fogarty, John Selby, B.D.S.; Gaudry, James Frederick Anthony, B.D.S.; Head, Harold Reid, B.D.S.; Knight, Noel Neville Charles, B.D.S.; Lawson, Kenneth Robin, B.D.S.; Martin, Kevin James, B.D.S.; Maunder, Keith Norman, B.D.S.; McClymont, James Bernard, B.D.S.; Pearson, John Hayton, B.D.Sc.; Stacy, Geoffrey Colman, B.D.S.; Ratcliffe, Donald Trevor, B.D.S.; Hall, Donald, B.D.S.

Deceased: It was noted with regret that Mr. R. B. Preston had died recently.

Student Associates: The Executive accepted, as Student Associates, the following Fourth Year students:

Guthrie, T. H.; May, William Donald; Hugh, Gerard; Eslake, Edward John; Arnold, Lionel Rupert; Kinross, John Stirton; Stricker, Alfred Gerald; O'Connell, William Francis; Boddy, Ian A.; Arnold, F. J. G.; Walsh, Paul Joseph; Smith, Roy Samuel; Walker, Geoffrey Michael; Rogers, Olbert William; McGrath, Francis Patrick; Tom, Clive Pearson; Pickering, Richard Bray; O'Brien, A. A.; Bell, John Edgar.

Financial Statement:

The Honorary Treasurer, Mr. F. R. Reid, tabled the financial statement for the month of February, 1951, which had been circulated to members of the Committee.

It was resolved that the financial statement for the month of February, 1951, be received.

General Business:

Re S. H. Neal of Taree: A letter was read from the Secretary of the North Eastern Division of the Association stating that Mr. H. S. Neal of Wingham was incorrectly minuted as delegate for that division, the correct delegate being Mr. S. H. Neal of Taree.

It was resolved that the minute of the Executive meeting held on 11th December, 1950, be amended to show the name of Mr. S. H. Neal as the divisional representative for the North Eastern Division.

Projector: The Chairman indicated that it had become obvious that at lectures at General Meetings and to country divisions a projector suitable for slides 2in. square was necessary. It was decided that the Secretary should investigate the proposed purchase and report full details to the next meeting of the Executive.

Doctors vs. Dentists Cricket Match: Mr. Edney reported that the match had taken place on Wednesday, 7th March with, however, only a small attendance to witness the match. The dentists had retained the shield, the match being drawn.

Closure of meeting: The meeting terminated at 10.30 p.m.

GENERAL MEETING

A General Meeting of the Association was held at the Lecture Hall, B.M.A. House, on Tuesday, 20th March, 1951, at 8 p.m.

There were present Dr. E. R. Magnus, President, in the Chair, and an audience of 92 members and visitors.

Mr. A. A. Wilson was elected as an Honorary Member of this Association.

Dr. R. N. McMullin delivered an interesting lecture on "The use of the new plastics in operative dentistry and crown and bridge prosthesis."

A discussion was opened by Dr. Bastian, and five members took part in this discussion.

The vote of thanks to Dr. McMullin for his lecture and Mr. J. Maclean of London for material which he had made available for Dr. McMullin was moved by Mr. Sullivan and carried by acclamation.

Dr. McMullin's paper will be published in this Journal at a later date.

New Books and Publications

Psychosomatics and Suggestion Therapy in Dentistry, by Jacob Stolzenberg, New York, 1950. Philosophical Library, Inc. *Our copy by courtesy of the publishers.*

Within a few years psychosomatics has come to be recognised as a scientific field in the study of medical problems. This is one of the first books which has been devoted to those aspects which are of special interest to the dental profession.

In his opening remarks, the author says that "the day of total divorce of medicine and specialties from the psychology of the patient is therefore definitely past, and some understanding of psychosomatics—that is to say the action of mind (psyche) on body (soma)—is not only valuable to the practitioner, but indispensable."

The dental profession seems to be lagging behind the medical profession in its recognition of the truth of this statement, and the author is to be commended for his efforts, shaky though they may be, to bring it home to his fellow dentists.

Following an introductory chapter devoted to psychosomatics in general, its more specific application to dentistry is dealt with under such headings as Fear, Emotional Factors in Periodontal Disease, Psychological Handling of Patients, Psychogenic Manifestations in the Oral Cavity. The final chapter is devoted entirely to a discussion of hypnodontics and is the best presented chapter in the book.

Despite the undoubted truth of the author's quoted premise, if psychosomatics is to be favourably recognised in the dental profession, it will have to be presented much more convincingly than has been done in this book. The text abounds with such phrases as: "It is now generally coming to be thought . . . . "; "It must be assumed that . . . . "; " . . . . is very apt to be connected with"; "It is well known that . . . . . ". Many surprising statements are made, which are entirely unsupported by evidence. For instance, it is claimed that Pacific Islanders withstood intolerable war situations without emotional crackup—when American soldiers did not—because they had enjoyed prolonged breast-feeding in infancy, combined with no forcible toilet training, and no prohibition on sexual play. This might be true, but it is equally possible that there might be a hundred other reasons for the difference in behaviour, and there is no supporting evidence to convince the critical reader.

There is little understanding of the underlying causes of such habits as thumb-sucking, and no proper appreciation of them as symptoms of more deeply seated maladjustments. Consequently, the treatment suggested is treatment of symptoms only, and there is strong evidence against both the efficacy and desirability of the obstructive methods advocated.

Psychology, of course, is not an exact science, and consequently the difficulties of presenting precise data in connection with psychosomatic manifestations are no doubt considerable. Nevertheless, ways and means of achieving a convincing presentation must be found, if this new field of endeavour is to receive the credit and attention which it undoubtedly deserves.—A.L.

The 1950 Year Book of Dentistry, edited by S. D. Tylman, *et al.*, Chicago, 1950. The Year Book Publishers. *Our copy by courtesy of the publishers.*

The Year Book Publishers have again produced a very compact and well-printed Year Book of Dentistry in conformity with those which have been issued previously. For the practitioner who desires to scan quickly through the more recent developments, such a book is undoubtedly of great interest and value and the editors are of such standing that one feels confident that the better works have been chosen for inclusion. The text is divided into eight main subjects, namely, diagnosis, pulpal and periodontal diseases, caries, public health, dentistry for children, orthodontics, surgery and related pathology, restorative and prosthetic dentistry. These subjects are further divided into chapters and, in addition, there is an adequate subject index and author index.

The main criticism that might be levelled at such a book is that the reporting is quite objective. Certainly many of the articles have small critical notes at the end of the abstract but one cannot but feel that possibly greater advantage might be gained if the work were presented in the form of a review. Such series as Physiological Reviews and Biochemical Reviews are so presented and are most valuable and time-saving for the persons interested in such matters.

A further extension that would prove most useful would be the inclusion of a list of those journals which are seen by the various editors. It is common practice for this to be done in books of a similar nature and it assists the reader in that he need not retrace his steps through numerous journals when attempting to review the literature in relation to a particular subject. It is gratifying to see that the work of a number of Australian authors is included in this Year Book.—H.R.S.

Printed and Published for the Proprietors, The Australian Dental Association, New South Wales Branch, B.M.A. House, 135-137 Macquarie Street, Sydney, by Simmons Limited, 31-33 Parramatta Road, Glebe, Sydney, N.S.W.